US010342355B2

(12) **United States Patent**
Derecktor et al.

(10) **Patent No.: US 10,342,355 B2**
(45) **Date of Patent: Jul. 9, 2019**

(54) **STOWABLE EXERCISE CHAIR FOR STANDING DESKS**

(71) Applicant: **Derecktor Marine Technology LLC**, Bristol, RI (US)

(72) Inventors: **Thomas Derecktor**, Portsmouth, RI (US); **Michael Miller**, Portsmouth, RI (US); **Rebecca Lorick**, Ann Arbor, MI (US)

(73) Assignee: **Derecktor Marine Technology LLC**, Bristol, RI (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/940,492**

(22) Filed: **Mar. 29, 2018**

(65) **Prior Publication Data**

US 2018/0279793 A1 Oct. 4, 2018

Related U.S. Application Data

(60) Provisional application No. 62/479,039, filed on Mar. 30, 2017.

(51) **Int. Cl.**
A47C 7/50 (2006.01)
A47C 9/00 (2006.01)
A63B 23/00 (2006.01)

(52) **U.S. Cl.**
CPC ***A47C 9/005*** (2013.01); ***A47C 7/503*** (2013.01); ***A47C 7/5066*** (2018.08); *A63B 2023/006* (2013.01); *A63B 2208/0233* (2013.01); *A63B 2210/02* (2013.01); *A63B 2210/50* (2013.01)

(58) **Field of Classification Search**
CPC A63B 23/0205; A63B 2208/0233; A63B 2023/006; A63B 2210/02; A63B 2210/50; A47C 7/5066; A47C 7/52; A47C 9/005; A47C 9/002; A47C 7/503; A47C 7/506
USPC 297/423.12, 423.11, 423.19, 195.11, 297/423.4, 258.1, 337, 214
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

135,924	A *	2/1873	Lyon	A47C 9/005 248/397
1,194,551	A *	8/1916	Schossler	A47C 9/002 108/2
4,650,249	A	3/1987	Serber	
5,149,174	A	9/1992	Charash	
5,255,957	A *	10/1993	Opsvik	A47C 9/005 297/423.12
6,398,699	B1 *	6/2002	Yang	A63B 22/14 482/142
7,108,642	B1	9/2006	Stearns	
7,367,623	B2 *	5/2008	Tholkes	A47C 9/005 297/300.8

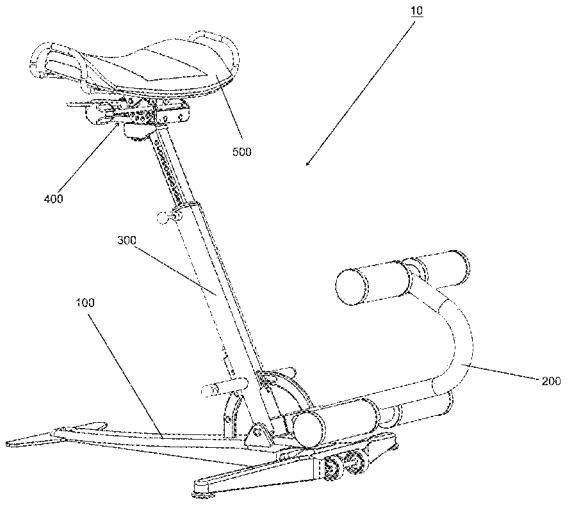
(Continued)

Primary Examiner — Milton Nelson, Jr.
(74) *Attorney, Agent, or Firm* — Barlow, Josephs & Holmes, LTD; David R. Josephs

(57) **ABSTRACT**

The chair of the present disclosure balances safety, comfort, ergonomics, numerous desk geometries, a variety of floor surfaces, the physics of cantilevered elements, the height of floor obstacles, and a large range of body types/sizes. It can address the recommendations of ergonomic experts and adds the unique forward footrest/exercise bar for stretching, core workouts, and to increase the variety of ergonomic seating positions. The entire product can fold into a compact light weight package for easy transport and stowage.

12 Claims, 23 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

7,407,225	B2 *	8/2008	Bigolin	B62J 1/08 248/298.1
2002/0101108	A1	8/2002	Roleder et al.	
2010/0125030	A1	5/2010	Shifferaw	
2013/0306831	A1	11/2013	Keen et al.	
2014/0159453	A1	6/2014	Elliott et al.	

* cited by examiner

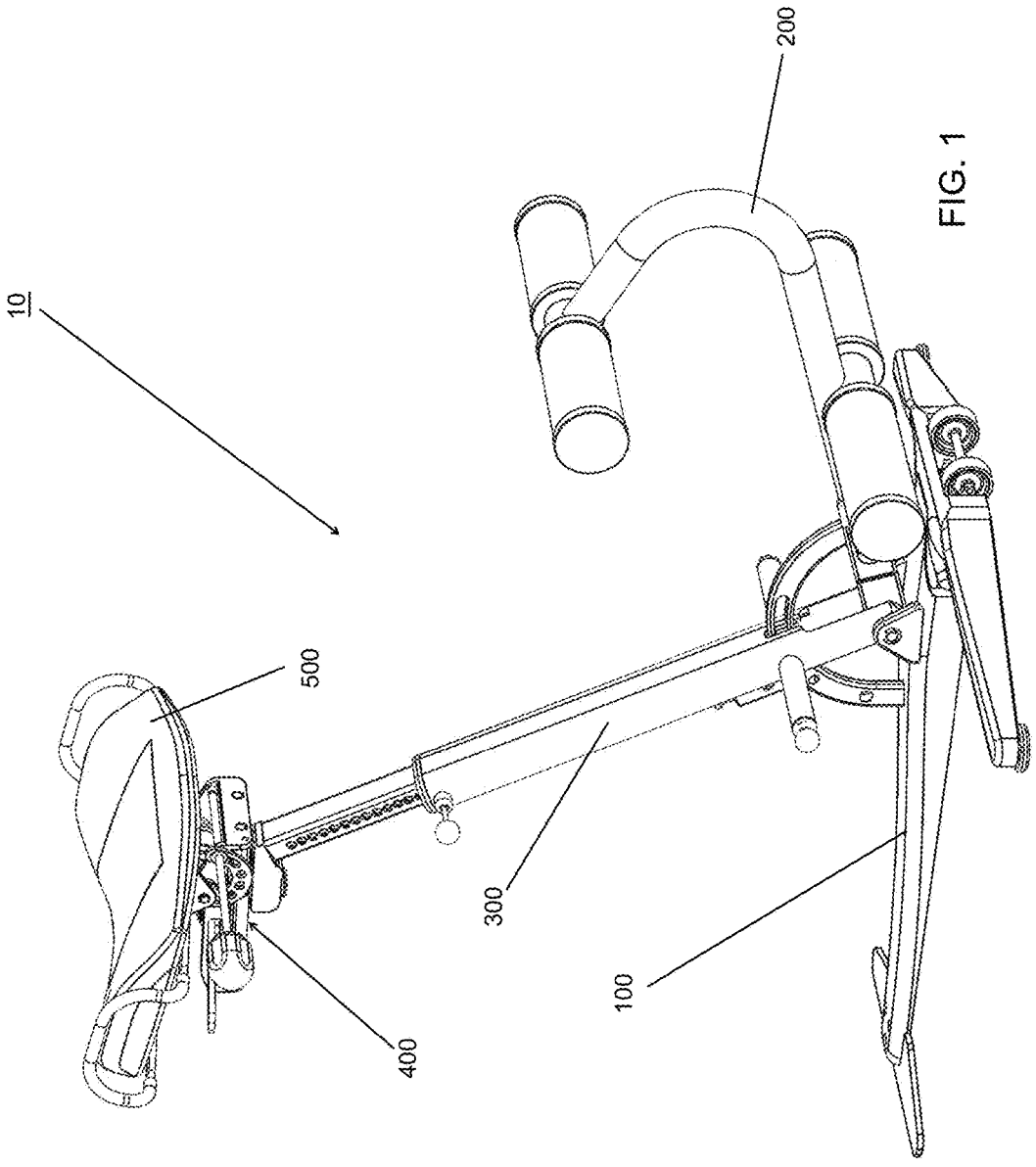


FIG. 1

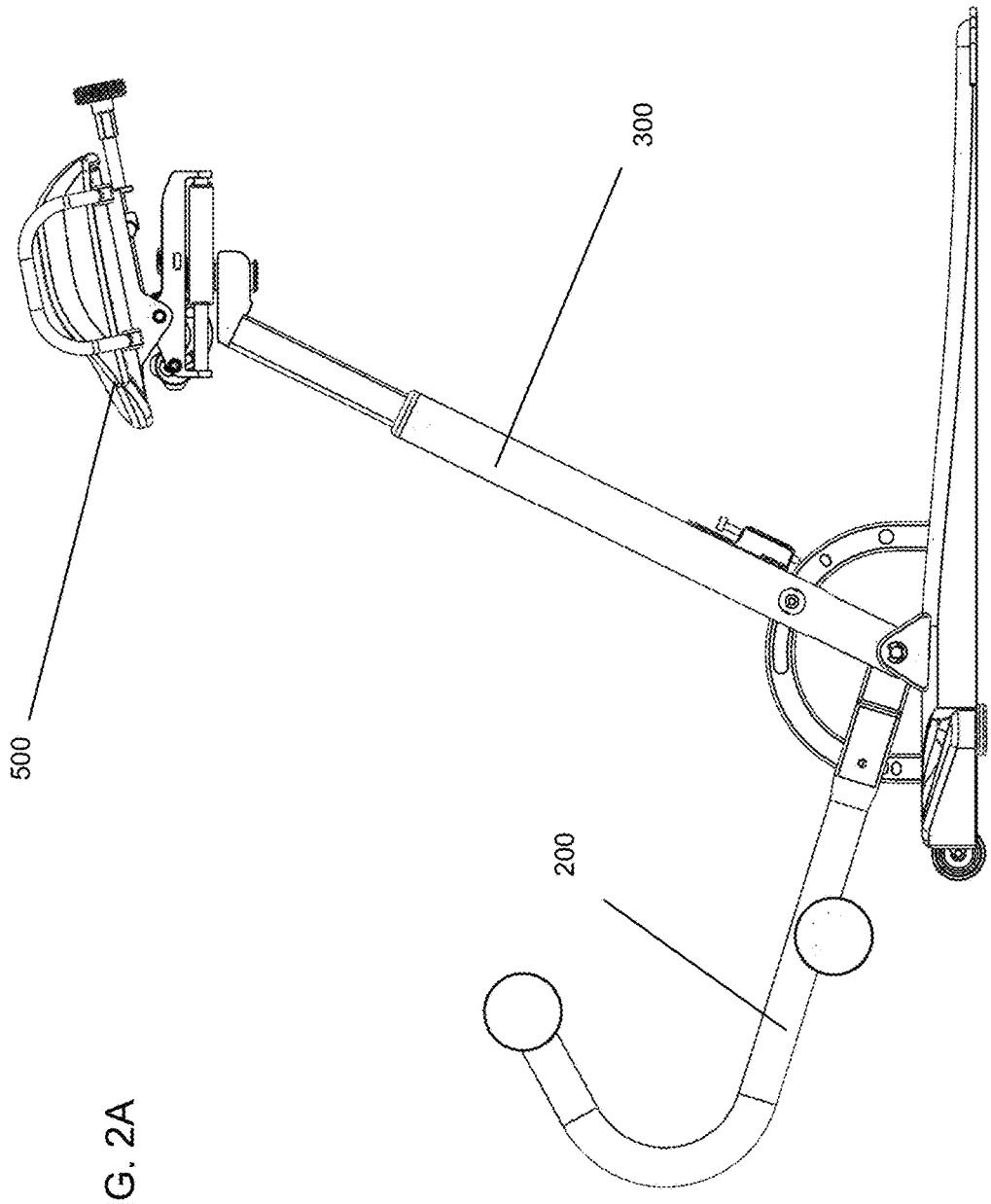


FIG. 2A

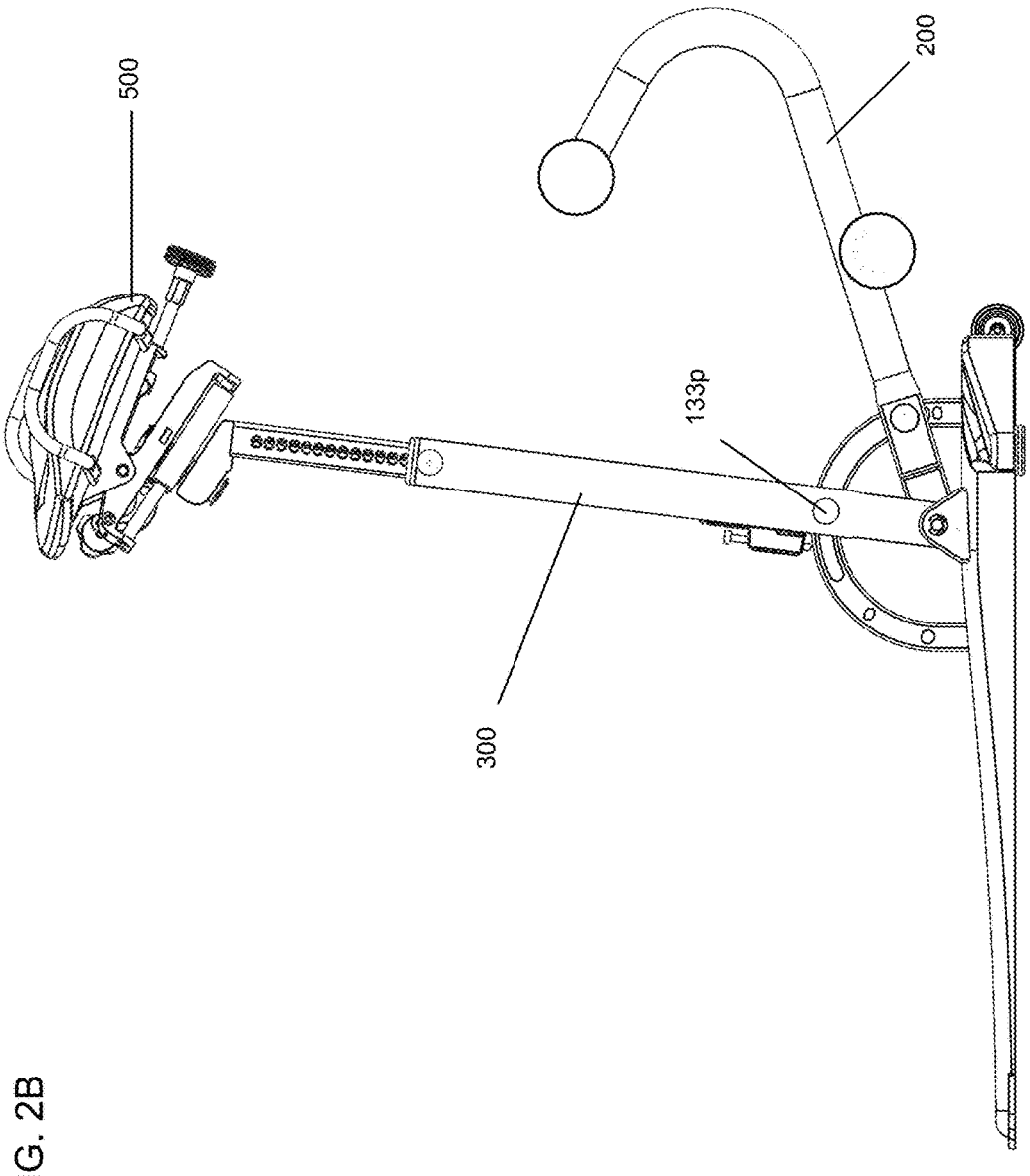


FIG. 2B

FIG. 2C

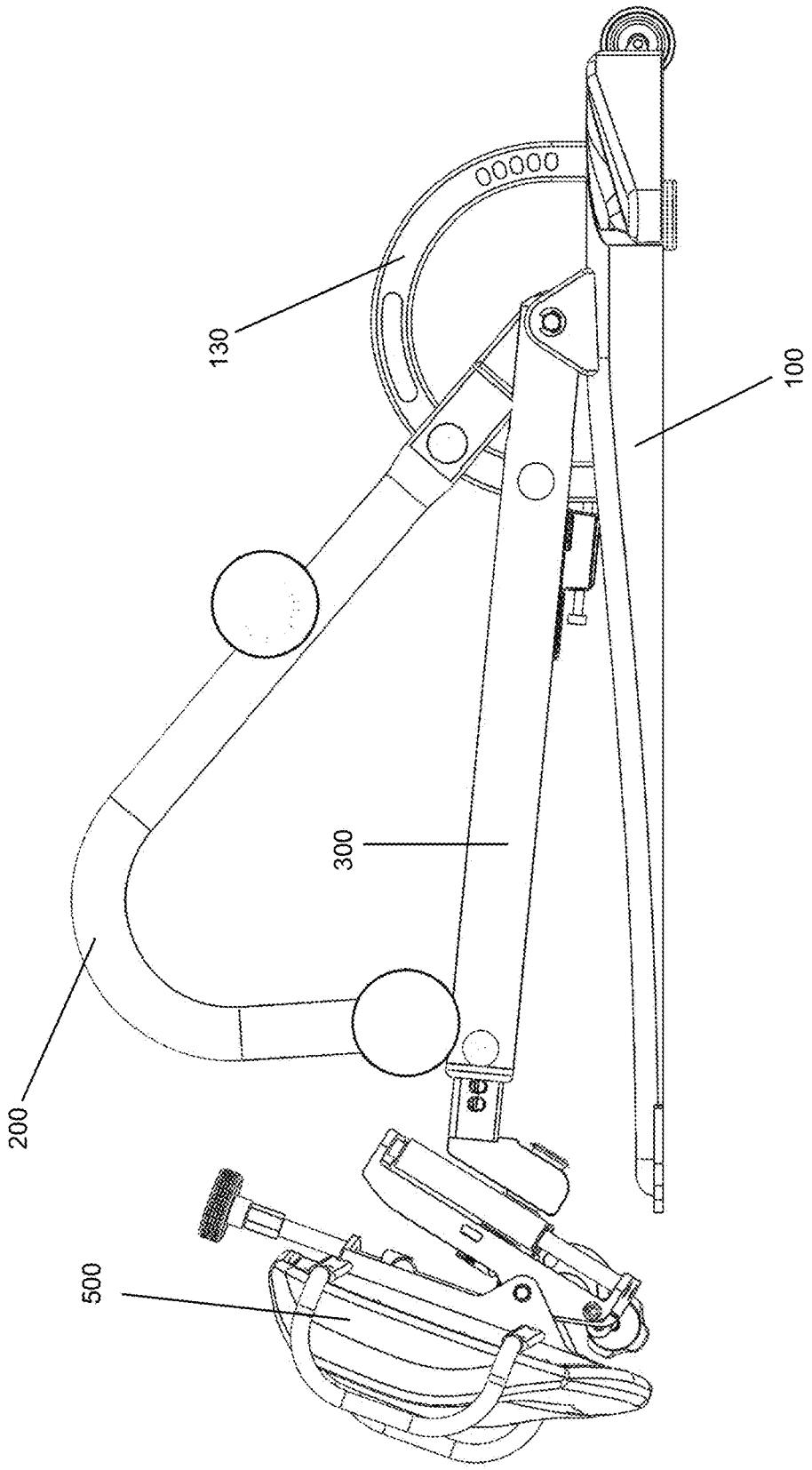


FIG. 3

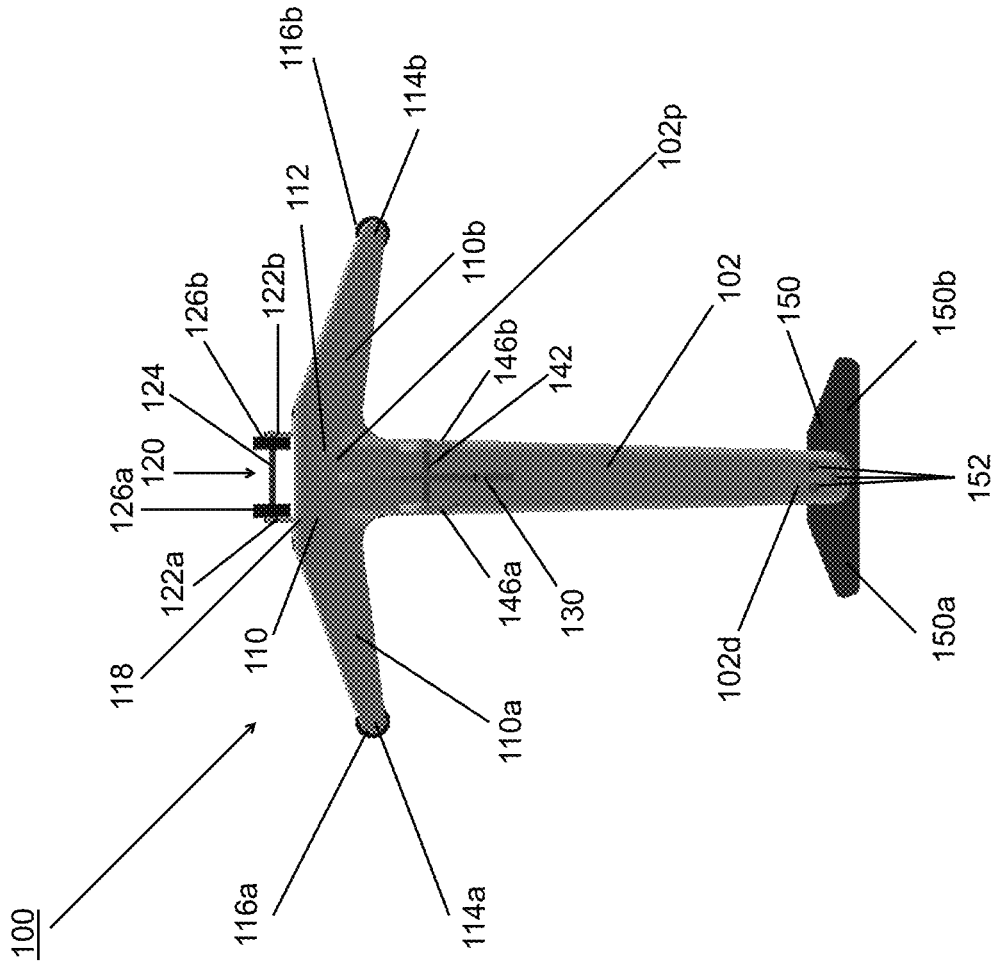
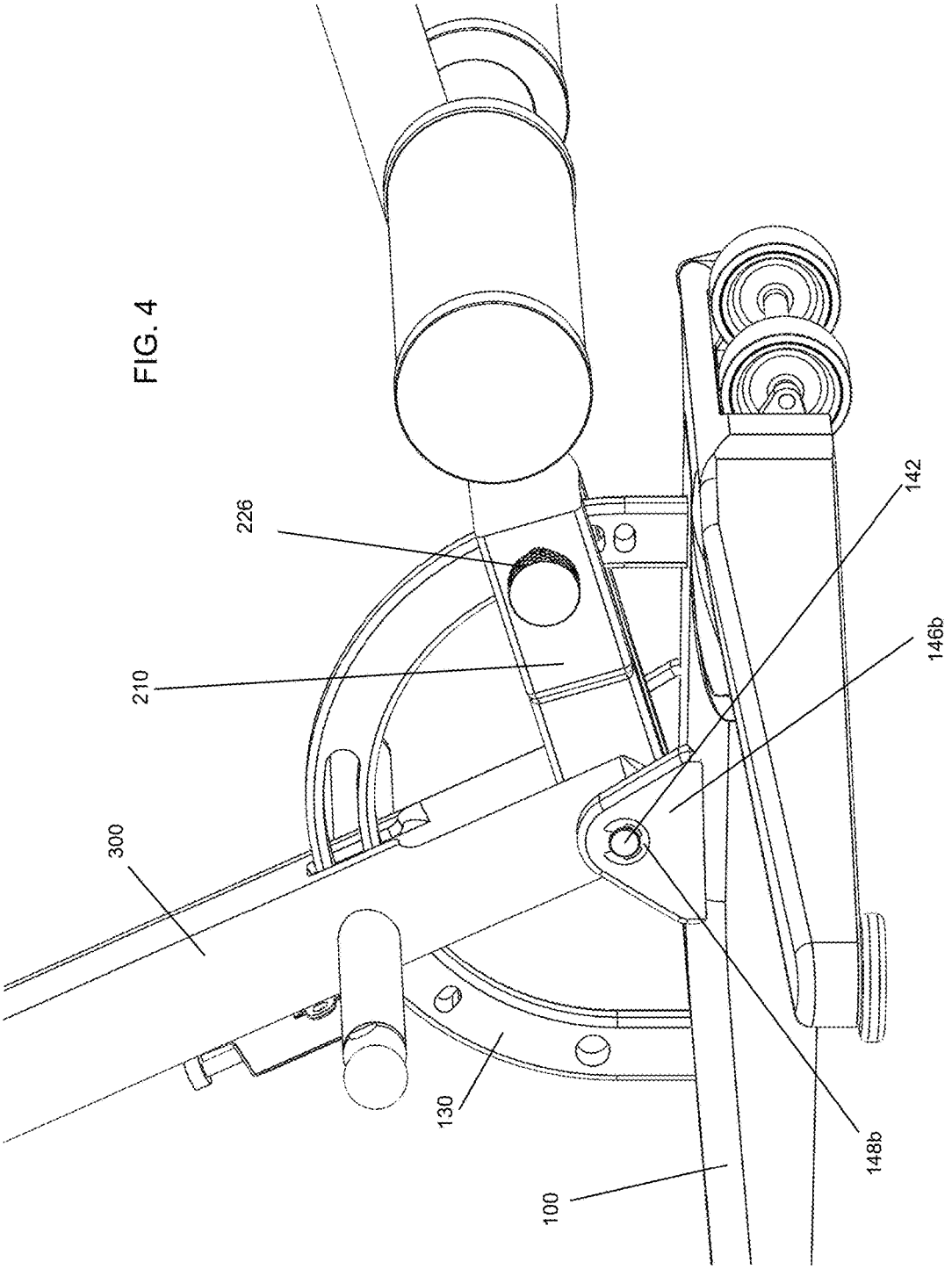

100
116a
114a
110a
118
110
122a
126a
120
124
126b
122b
112
116b
114b
110b
102p
102
150
150b
152
150a
102d
130
146a
142
146b

FIG. 4



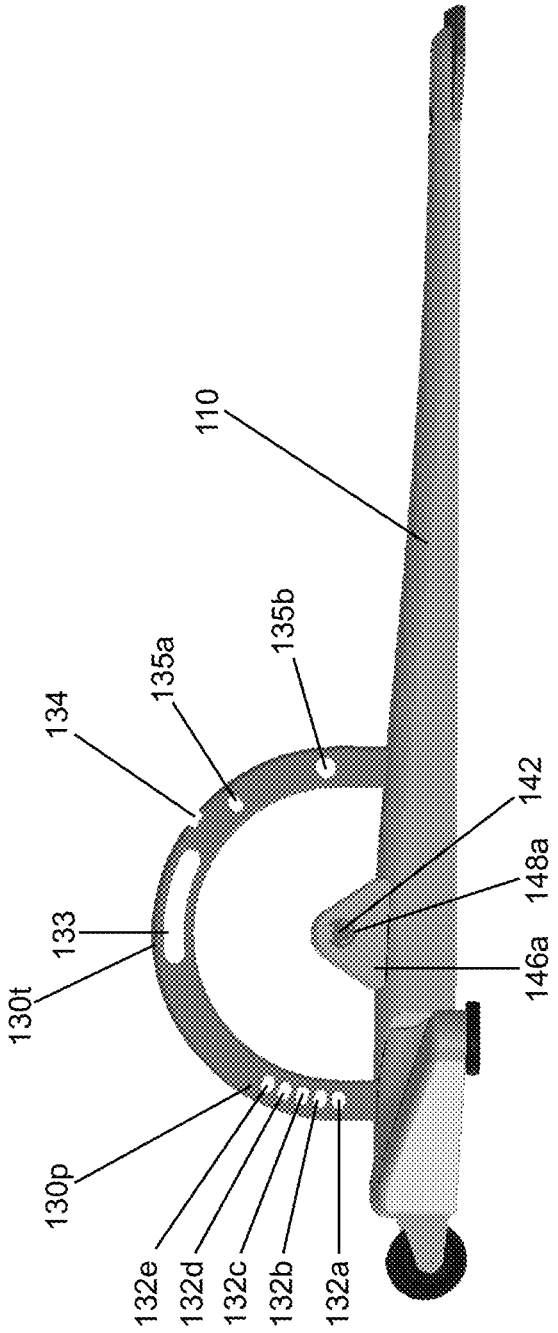
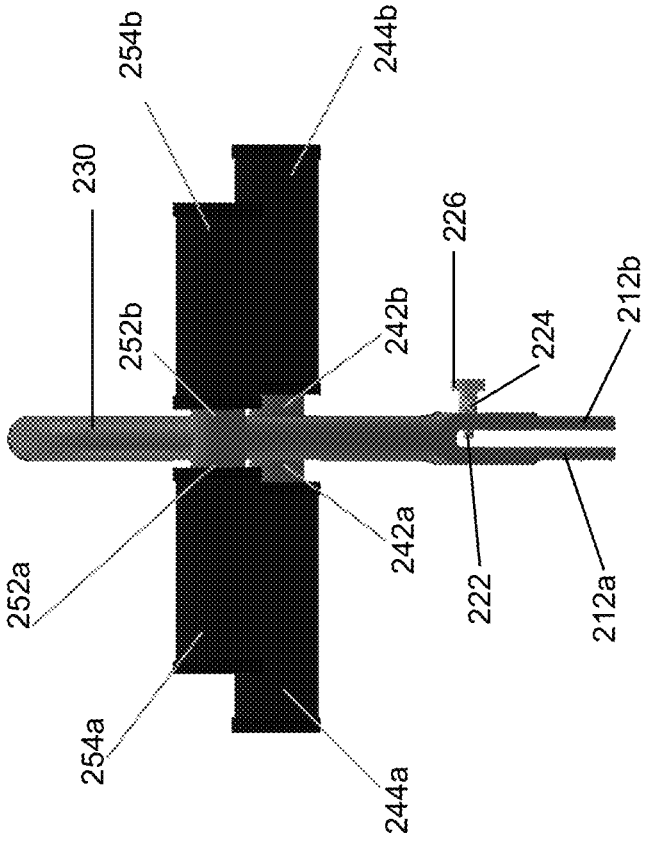

110
135b
135a
134
142
148a
133
146a
130t
130p
132e
132d
132c
132b
132a

FIG. 5

FIG. 6


254b
244b
230
226
252b
242b
224
212b
252a
242a
222
212a
254a
244a

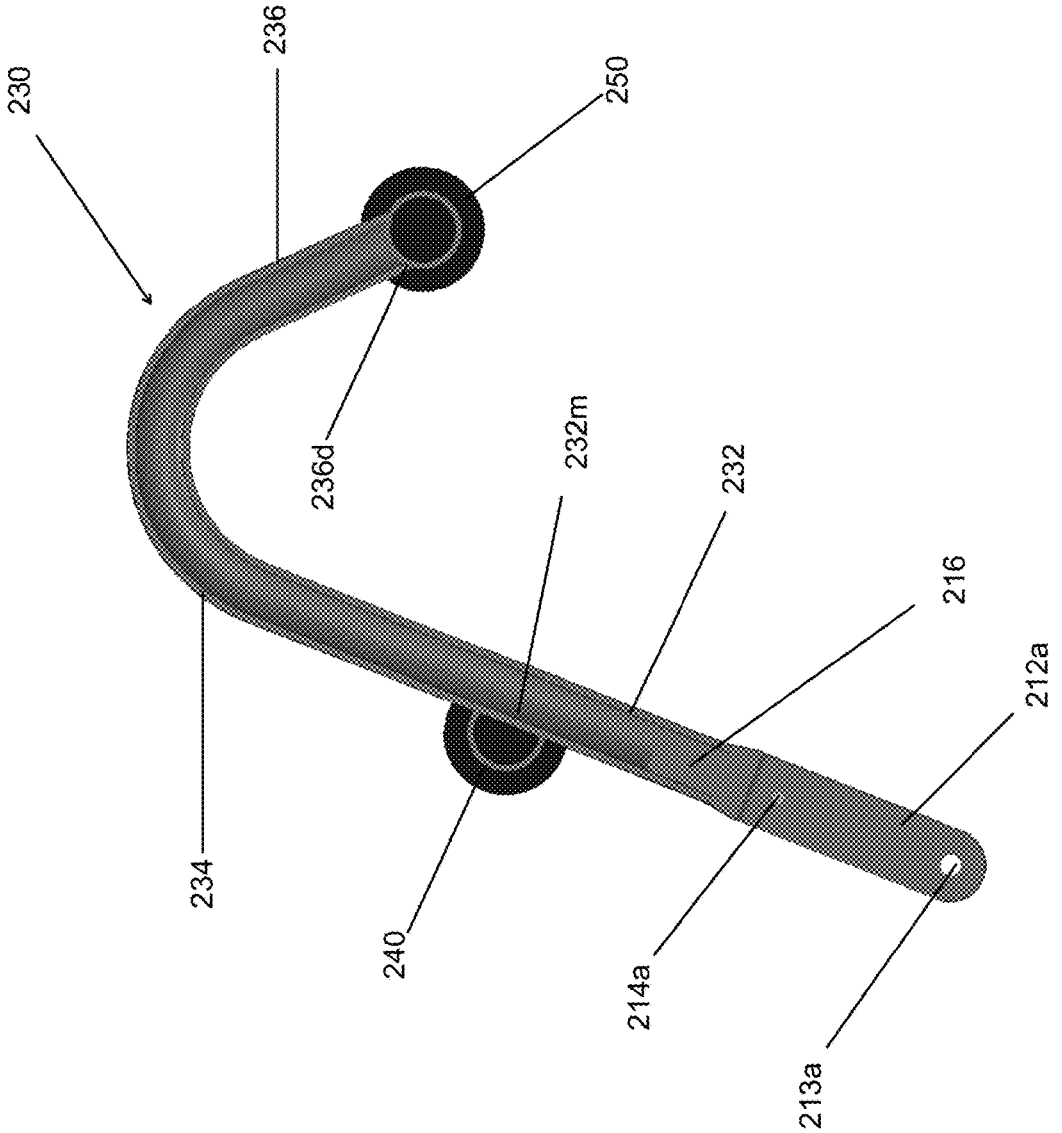
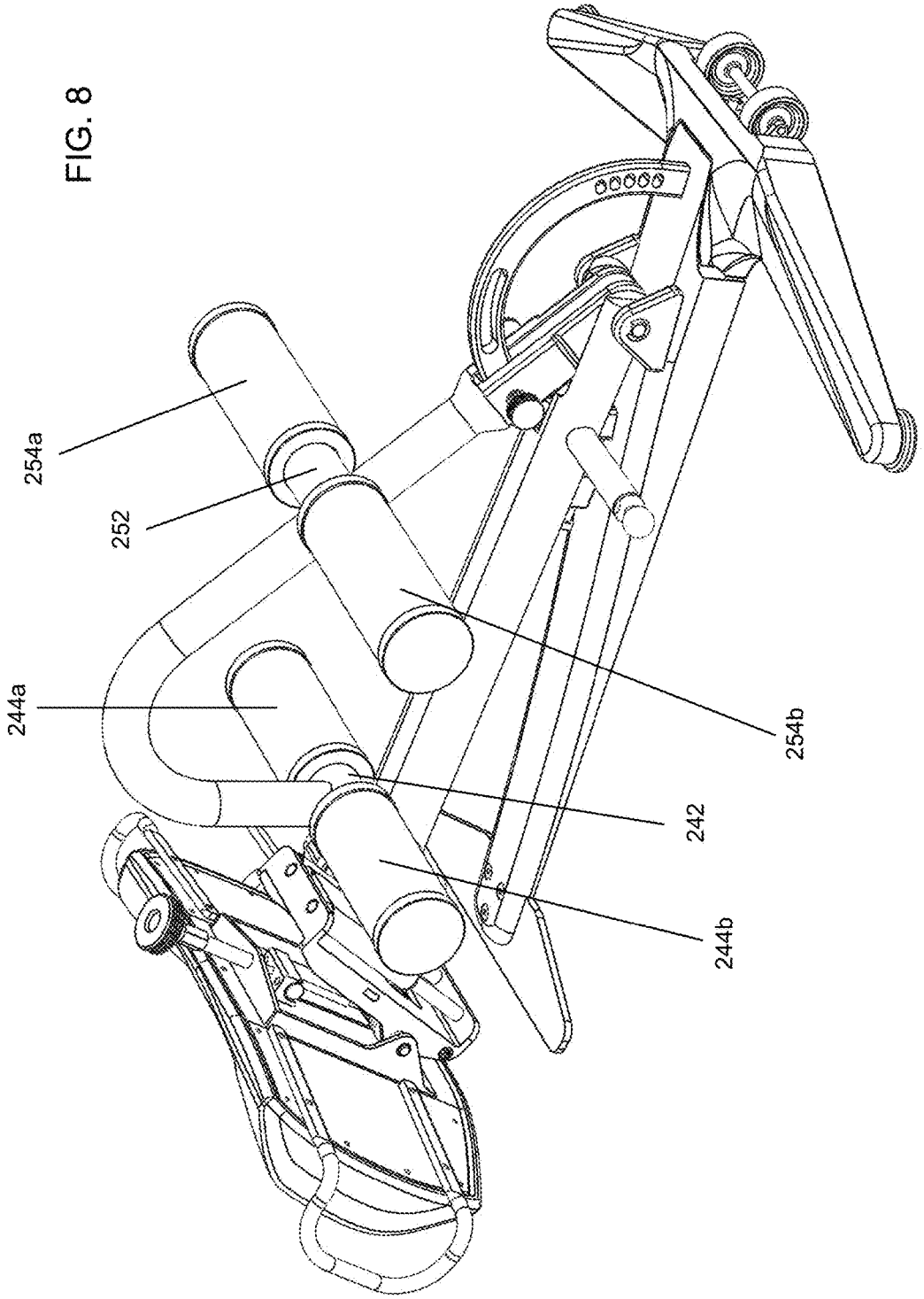


FIG. 7

FIG. 8



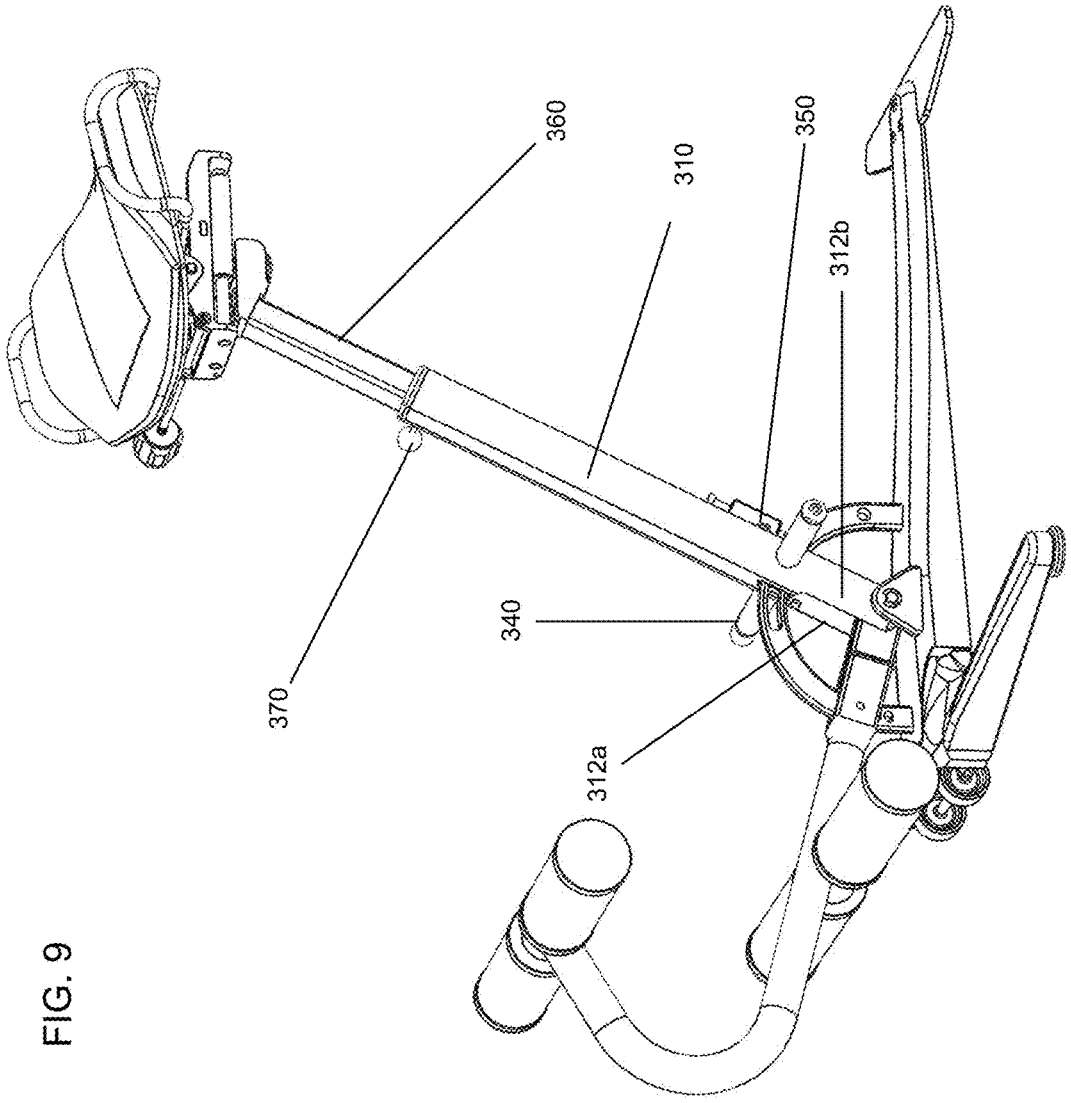


FIG. 9

FIG. 10

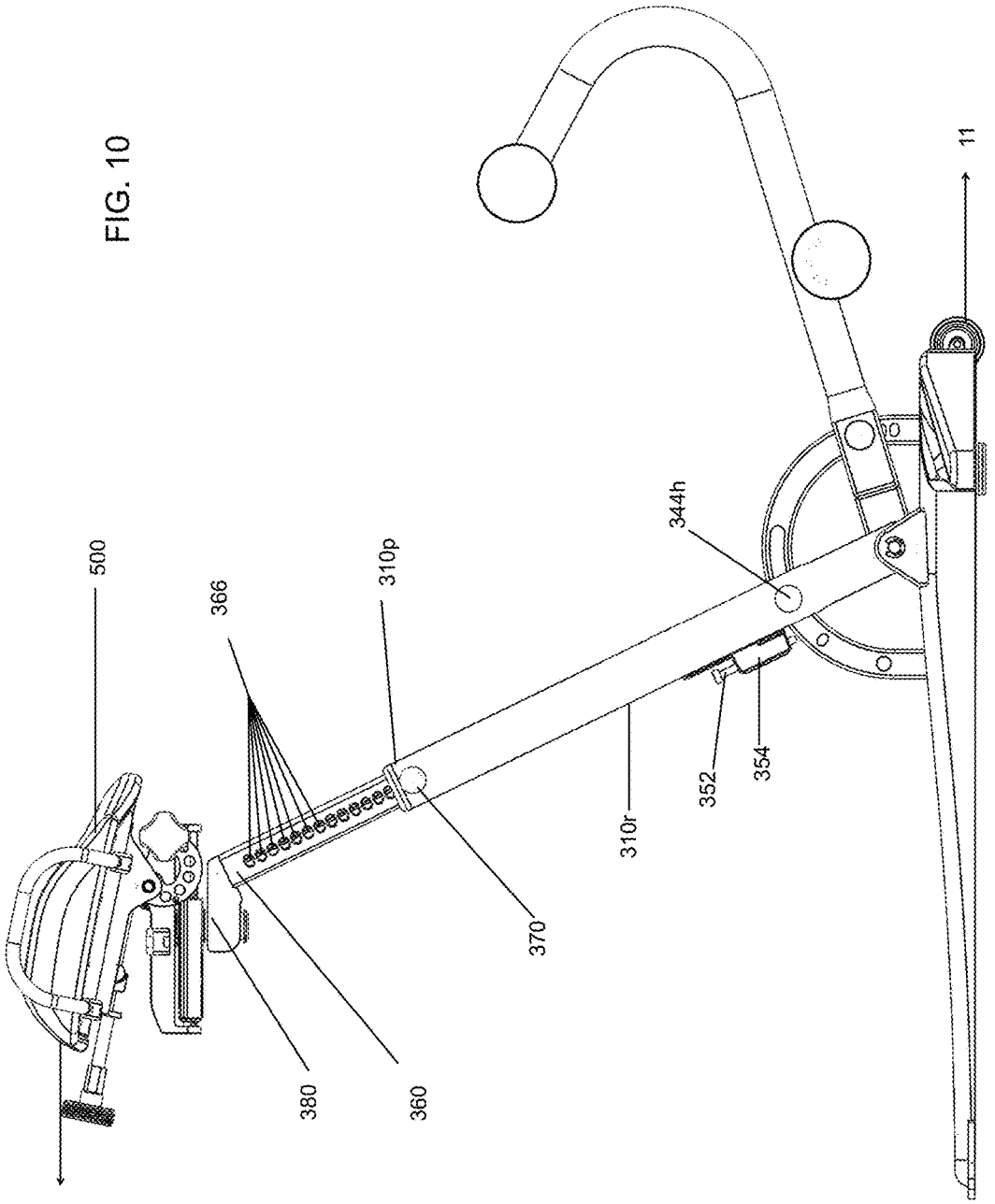


FIG. 11

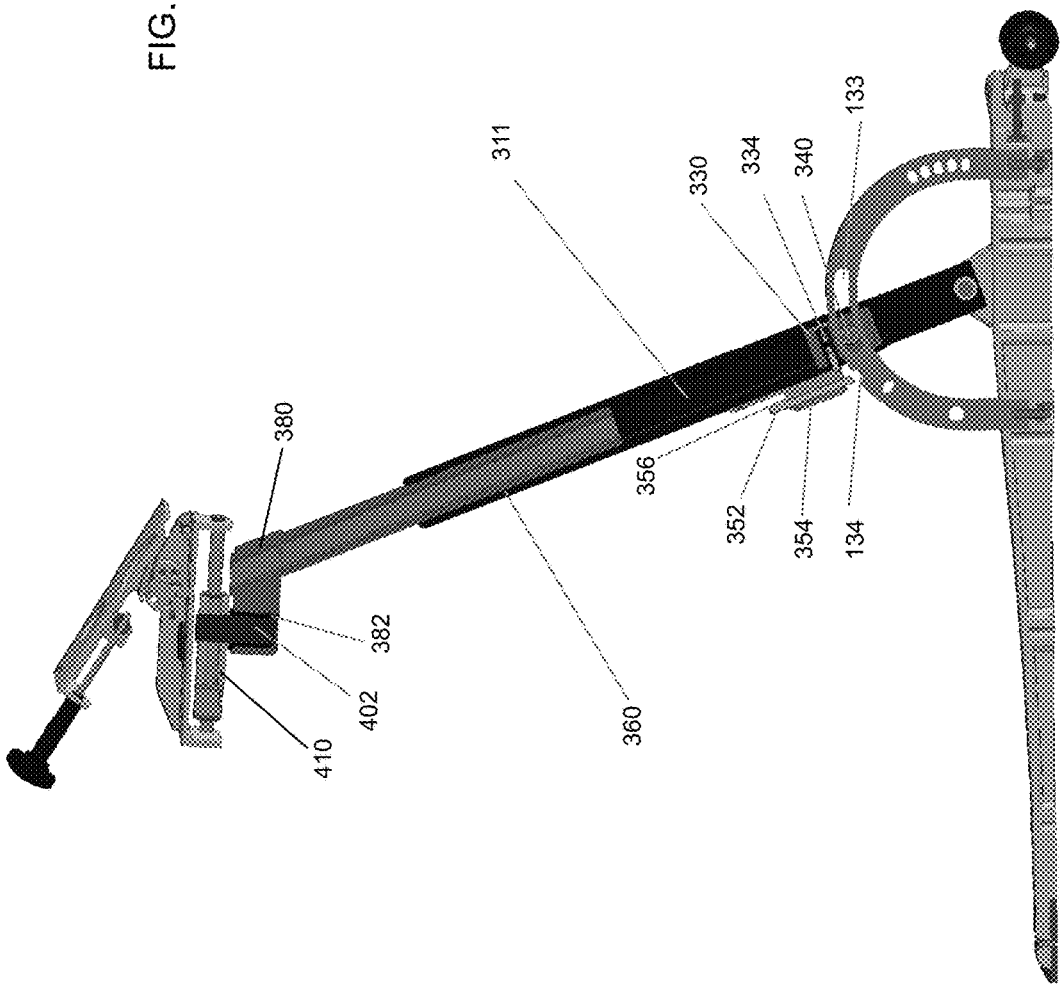
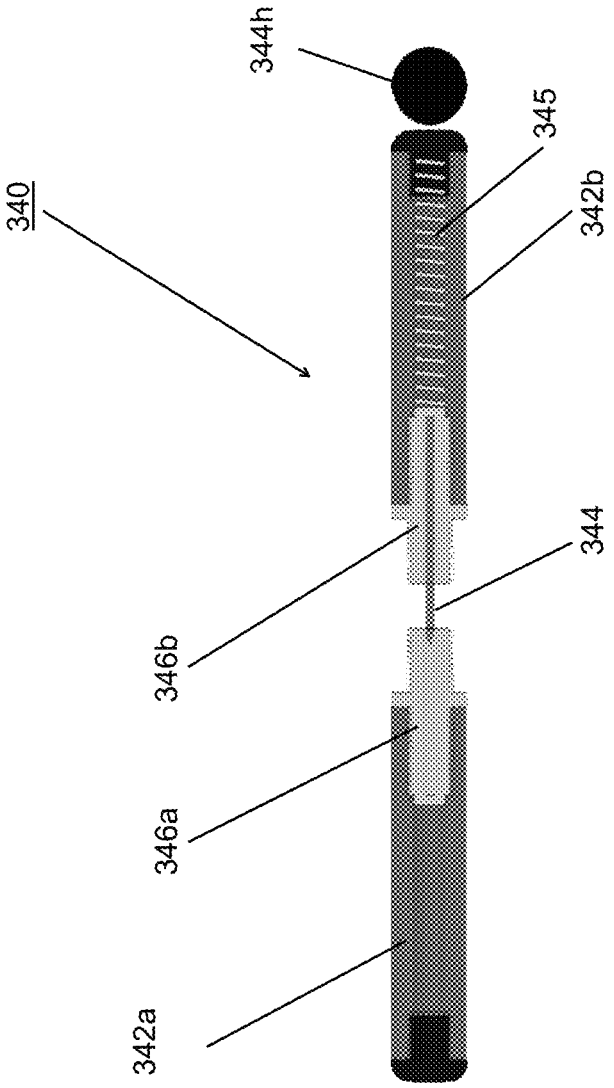


FIG. 12



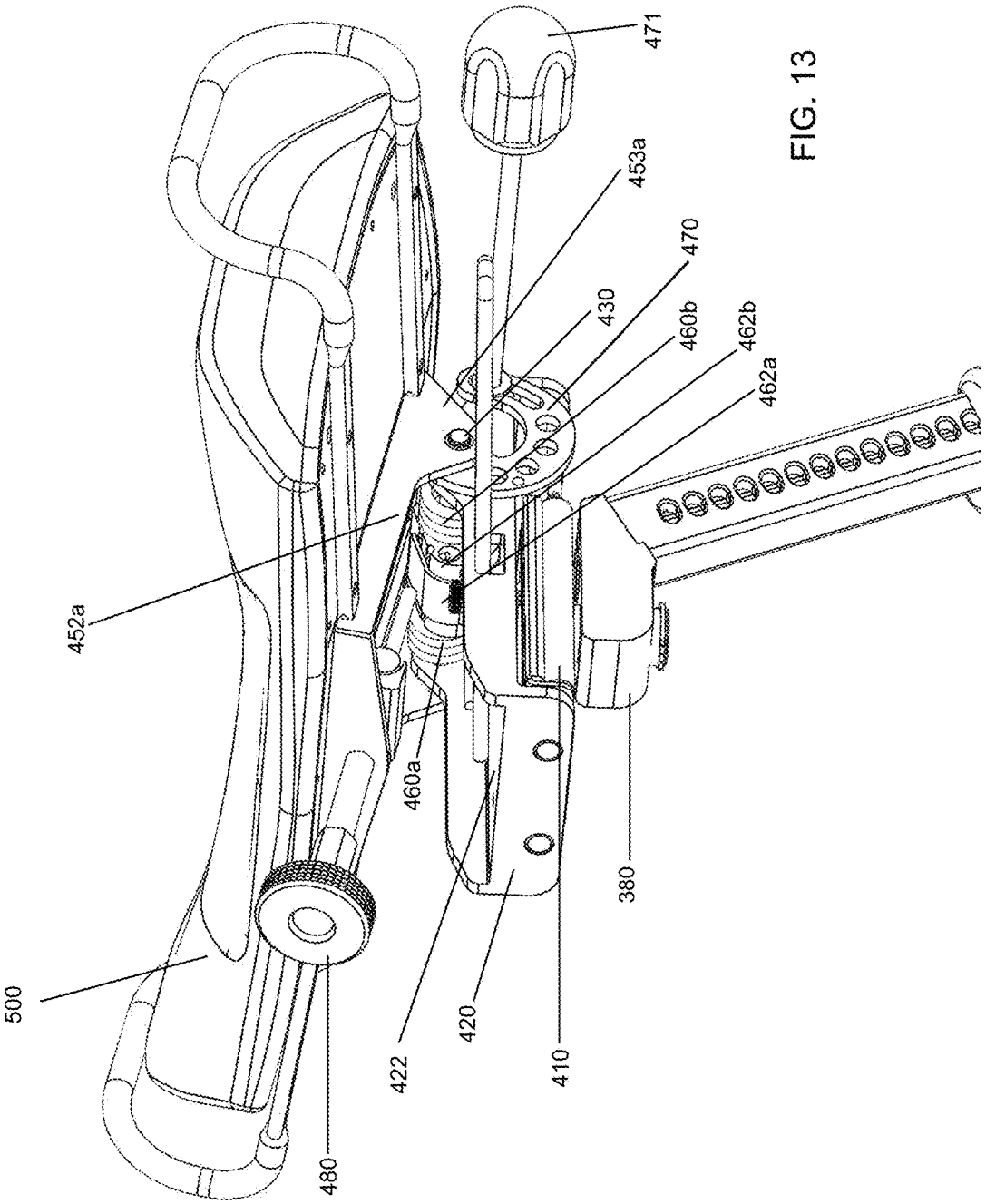

471
453a
470
430
460b
462b
462a
452a
460a
380
500
422
420
410
480

FIG. 13

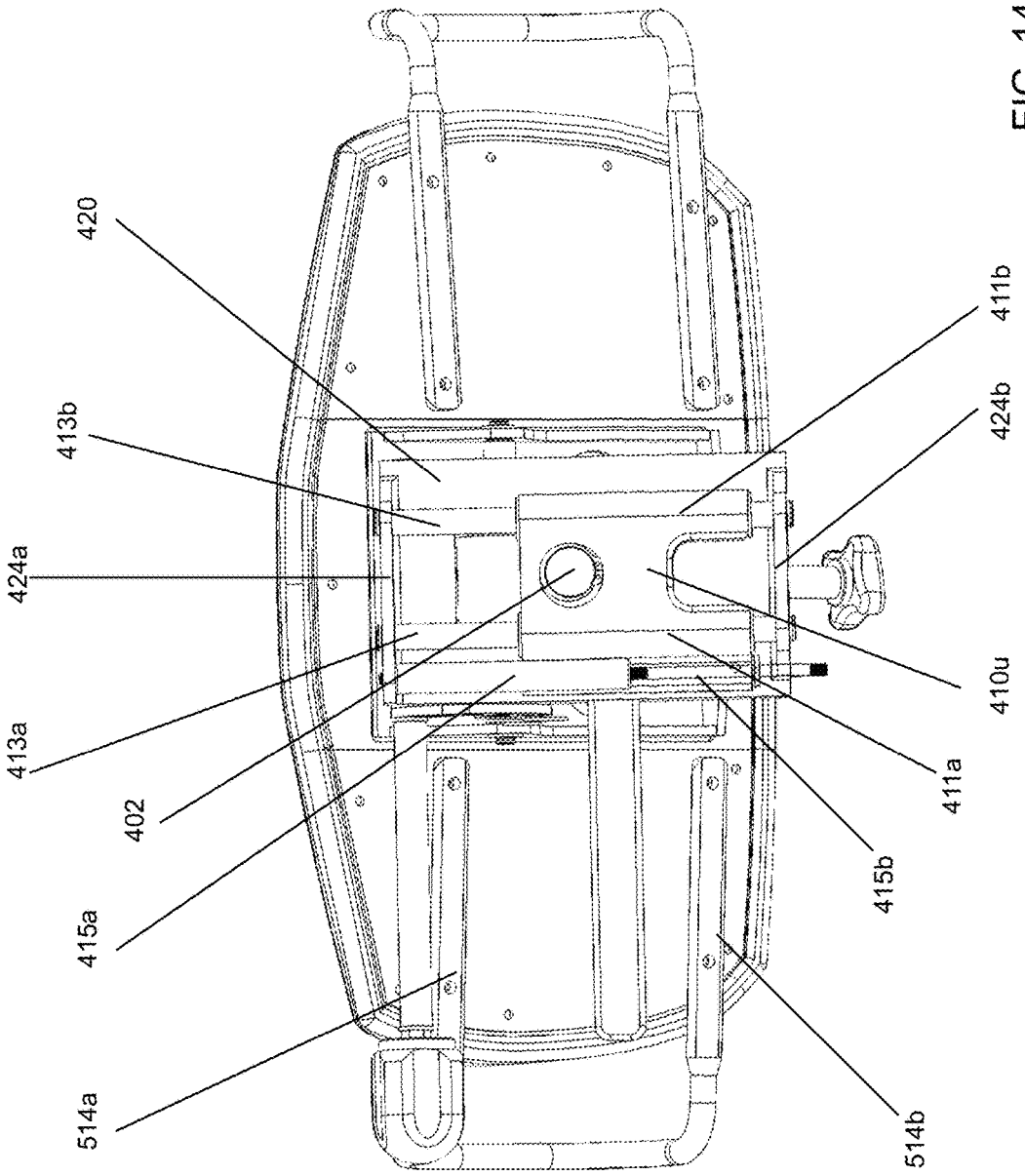

420
413b
424a
413a
402
415a
514a
411b
424b
410u
411a
415b
514b

FIG. 14

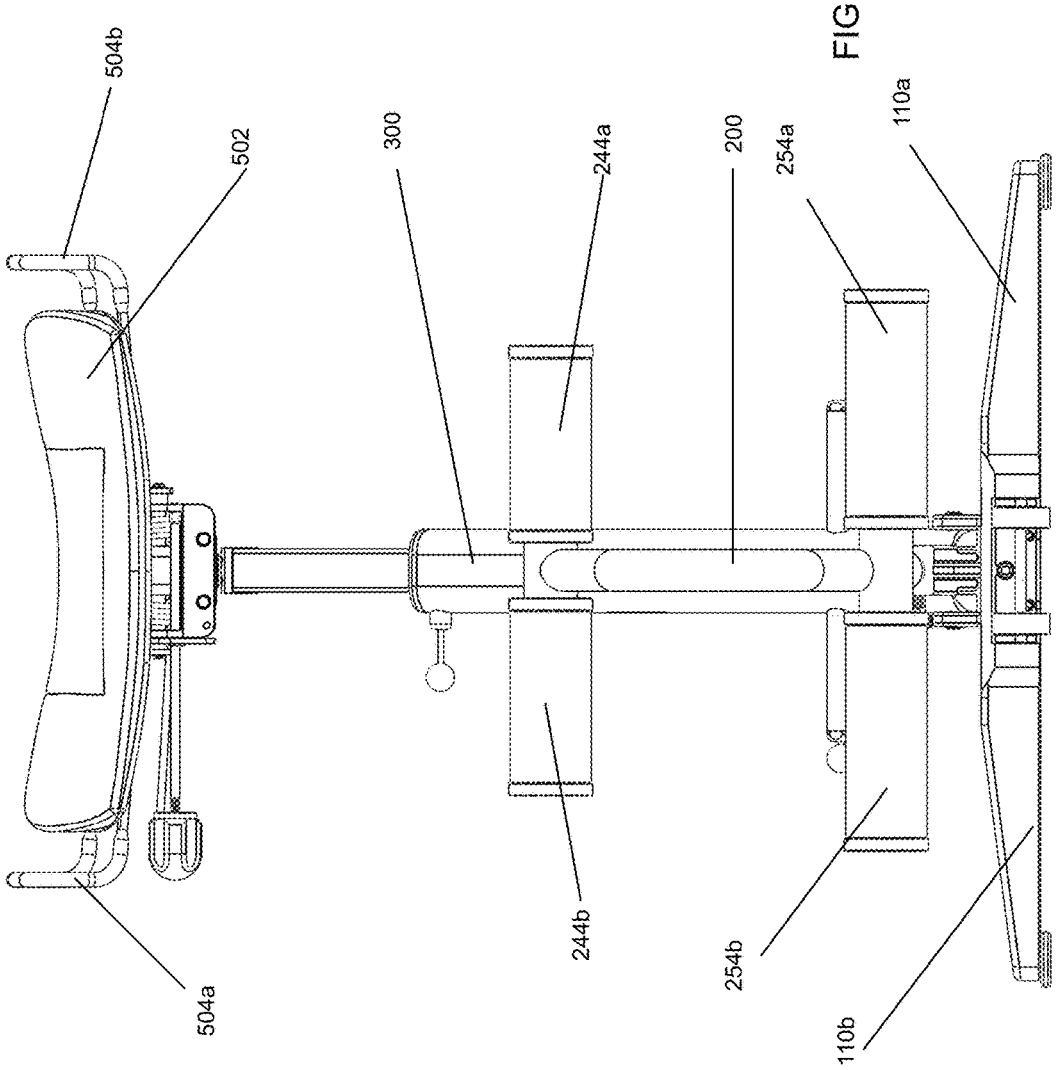


FIG. 15

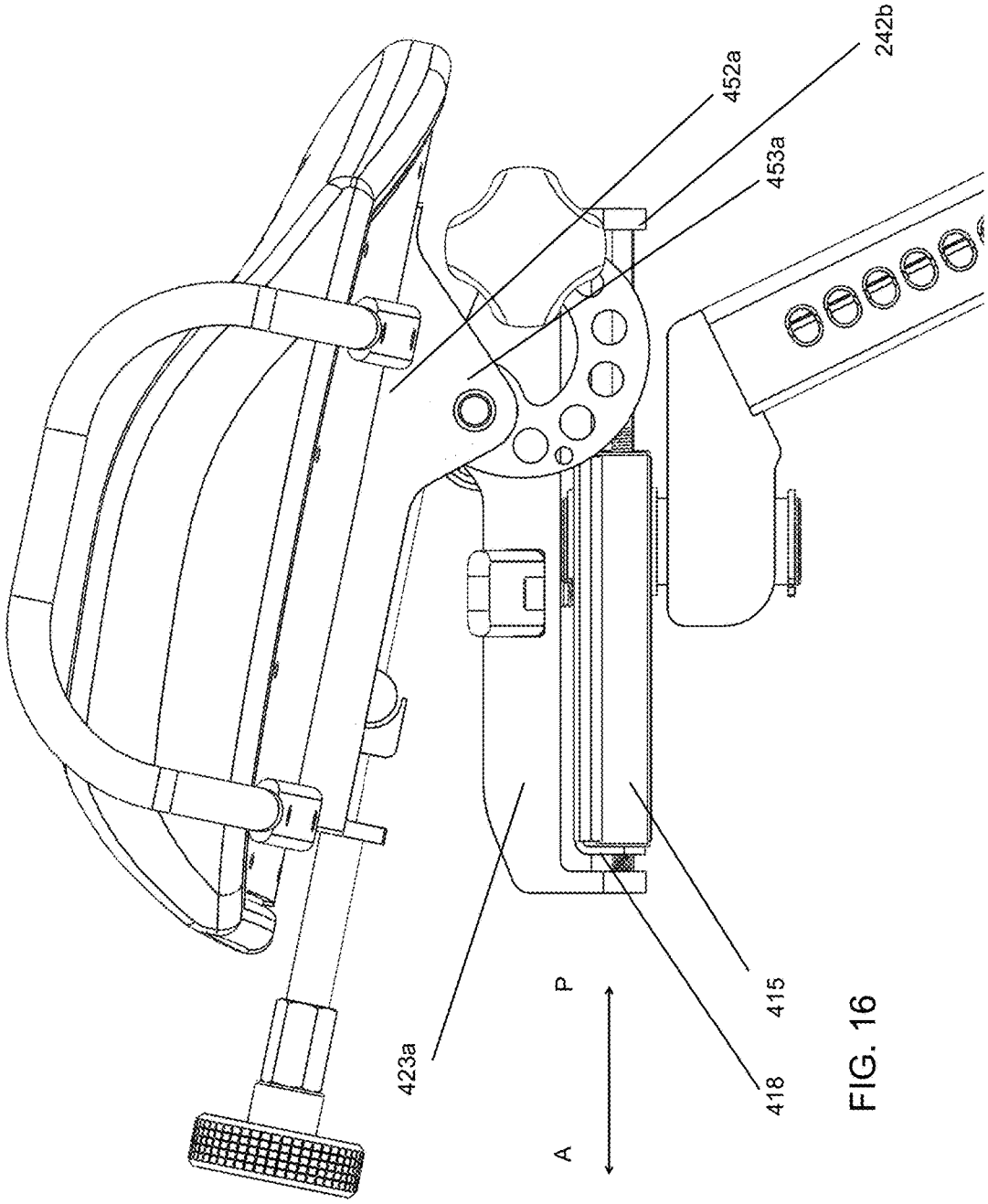


FIG. 16

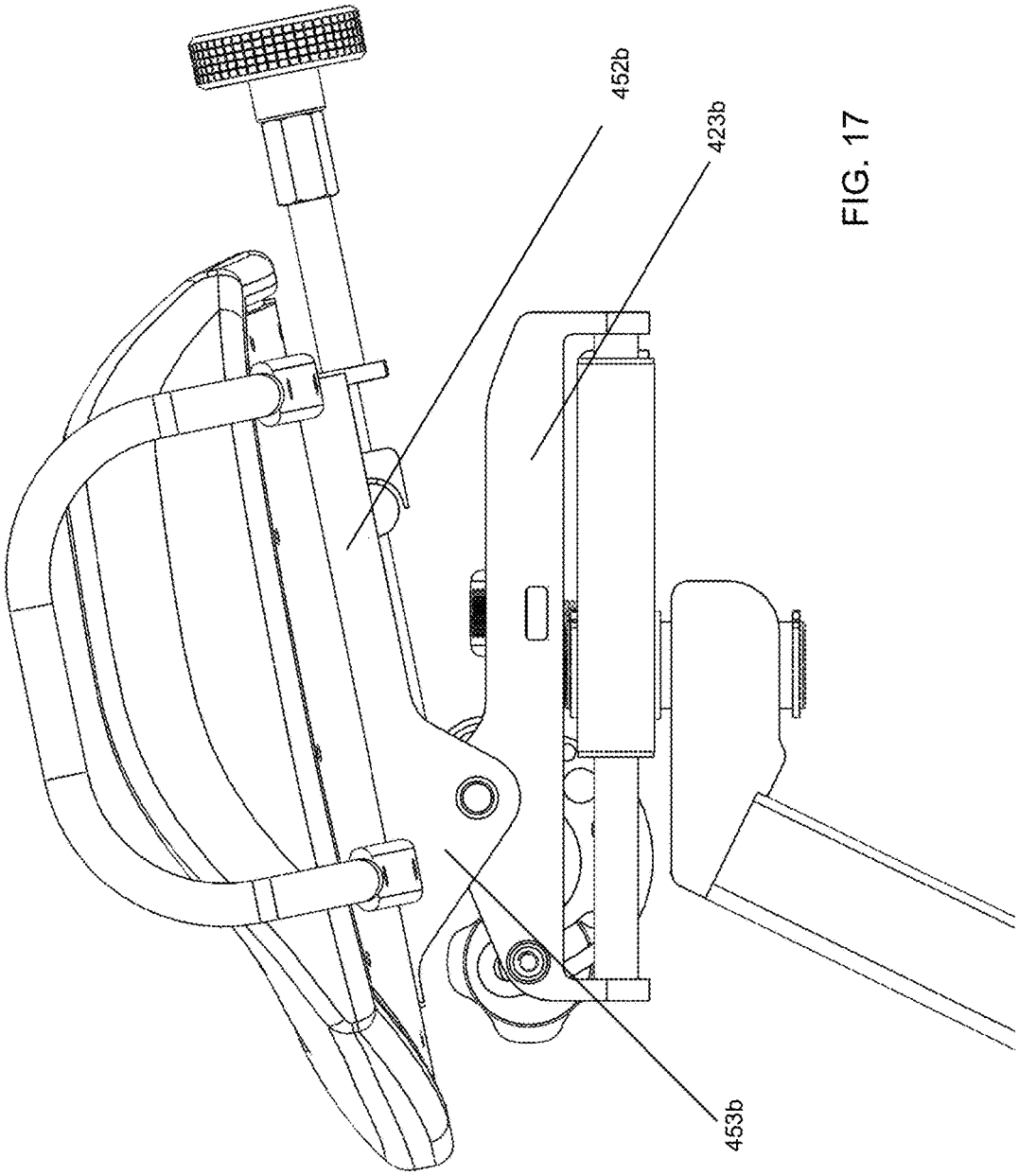


FIG. 17

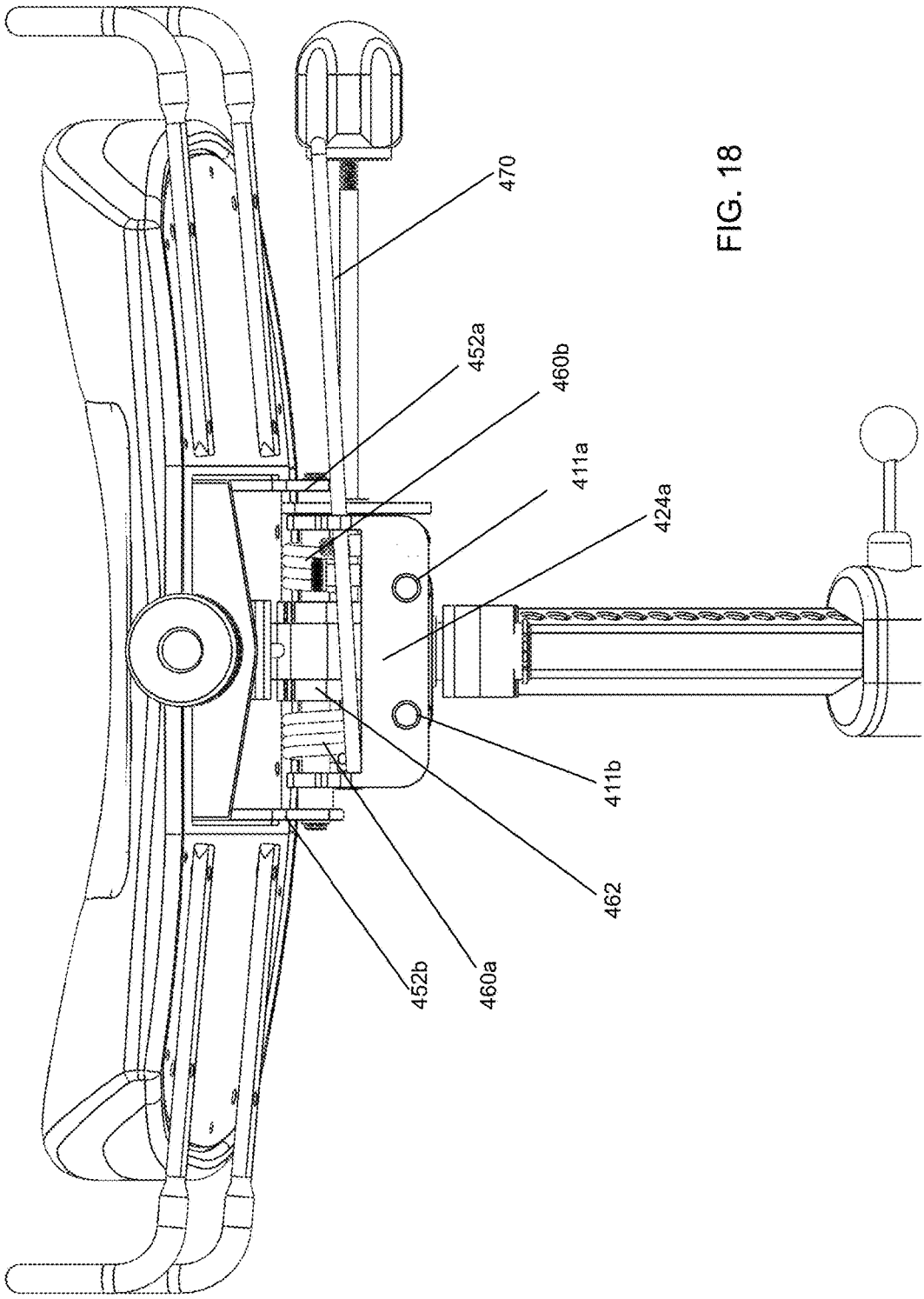
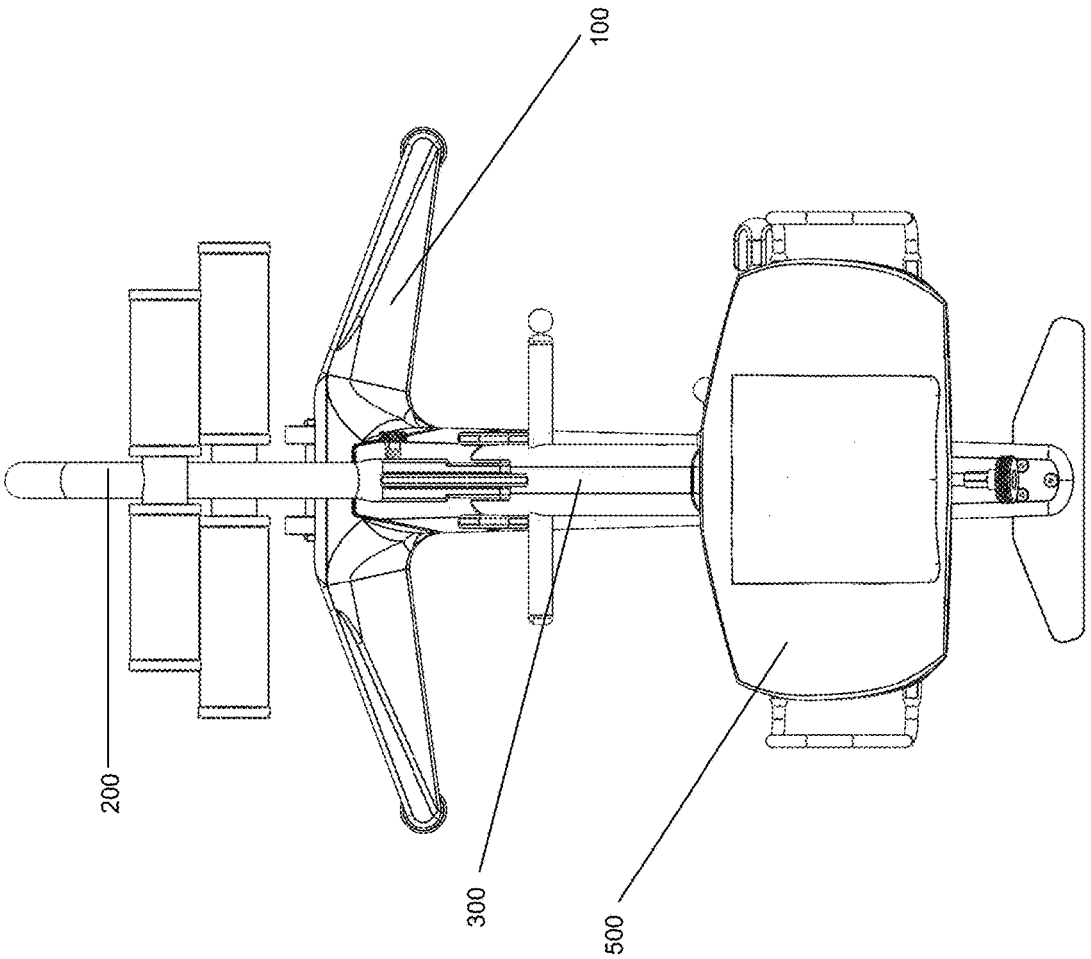


FIG. 18

FIG. 19



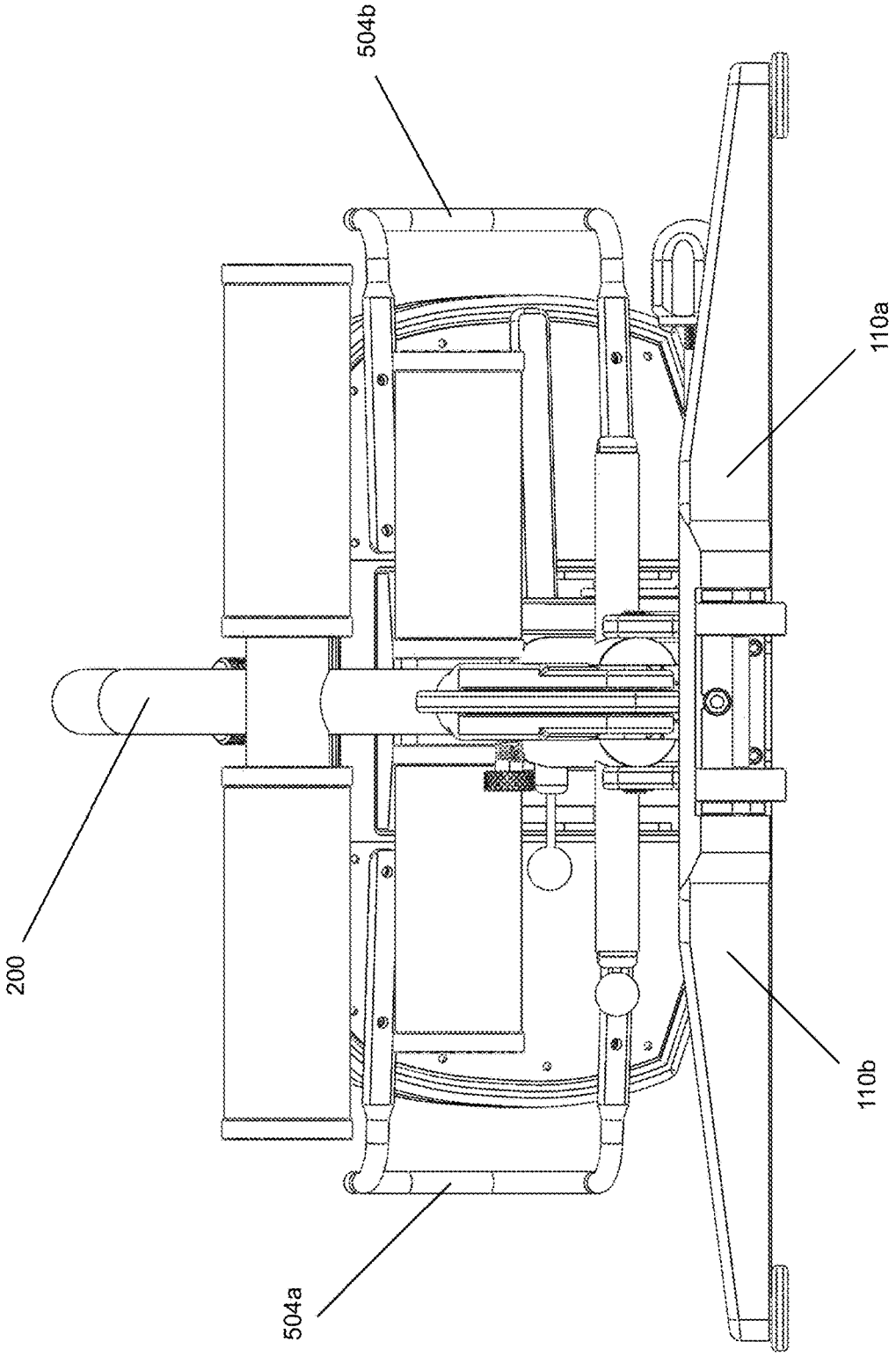


FIG. 20

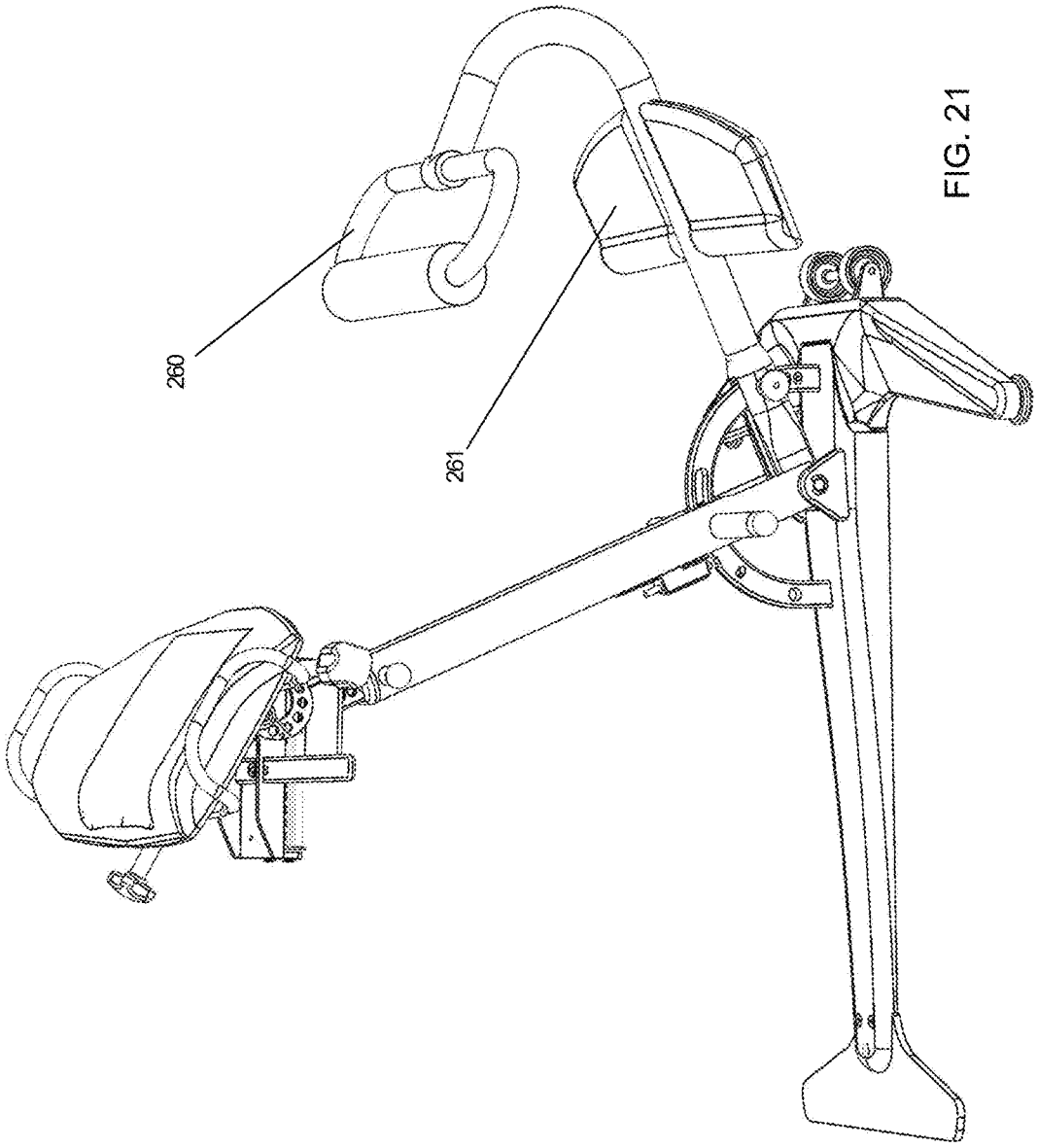


FIG. 21

STOWABLE EXERCISE CHAIR FOR STANDING DESKS

CROSS REFERENCE TO RELATED APPLICATION

This application is related to and claims priority from the filed U.S. Provisional Application No. 62/479,039, filed Mar. 30, 2017, entitled "STOWABLE EXERCISE CHAIR FOR STANDING DESKS," incorporated by reference in its entirety herein.

BACKGROUND

The present disclosure is related generally to seating, desks, tables and other structures for supporting a person or objects. It is particularly useful for all users of standup desks, professionals, academics, programmers, architects, engineers, sailors, cyclists, basically anyone seeking a core workout, or an active seating experience at a desk, with healthier more ergonomic seating options and the like.

It is increasingly well known in the ergonomic office furniture industry that standup desks have the potential to provide a significant healthy benefit for the user. However, as with sitting, standing sedentarily for long periods of time may increase the users risk of developing physical pain and other health issues. As a result, standing desks need to be paired with an ergonomic standing chair that can support the user when fatigued and allow the user to take breaks from standing.

In addition, scientists in the fields of biology, biomechanics, and ergonomics have identified serious health risks—from back pain to increased risk of heart disease and diabetes—that result from sitting in the wrong ergonomic position and from sitting or standing in static positions for extended periods of time. In August of 2016, the American Heart Association published a review of many of this current research in the journal, *Circulation*. After reviewing this data, they concluded that people should try to "move more and sit less" in order to mitigate the health risks associated with being sedentary for too long. Thus, there is a significant need to design furniture that addresses the health problems associated with seating arrangements that result in poor ergonomic postures and the lack of physical activity/movement. There have been many attempts in the prior art to meet these needs. However, each of the current known prior art standup chairs suffer from at least one of the following problems:

a. They are in the way when not in use.
b. They don't allow easy transitions between sitting and standing or between different positions while seating.
c. Little additional exercise benefit is provided by the chair.
d. There is no sit-up, back extension, or stretching exercise capability provided by the chair.
e. Foot rests are often uncomfortably located directly below the chair, which is ergonomically undesirable. Further, no footrests are available that extend in front of the user.
f. They do not include multiple footrests that support the user while sitting in a variety of postures.
g. They do not include footrests and pegs that can be used while standing to facilitate more dynamic and ergonomic standing positions.

h. They do not include an ergonomic seat pan that is designed to optimally position and actively rotate the pelvis and support the spine in more than one healthy sitting or leaning posture.
i. Lack of ease of storage and transport.

Numerous companies manufacture seating solutions that attempt to solve some of the problems listed above. Some of these are designed to provide more active seating and encourage movement for the user at both regular and standing height desks, and some are designed to provide seating options specifically for standing height desks. While they each have unique features and benefits, none of them provide a solution that is able to address all of the foregoing problems. In addition, none are designed to provide the type of exercise that the chair of the present disclosure provides. They also do not optimally allow desk workers to move easily between a wide variety of seated and standing positions so that they can be more active throughout the work day and thus mitigate some of the health risks associated with static sitting or standing for long periods of time. While many of these products are able to support you in a few different postures (e.g., sitting and standing, or sitting and leaning), none of them are able to support you in the full range of sitting, standing, perching, and leaning postures that the present disclosure provides.

Despite the foregoing efforts in the prior art, there is still a need to provide easy transitions between sitting and standing or between different ergonomic positions while seating. There is a demand for providing additional exercise benefit capabilities such as sit-up, back extension, and stretching exercises. There is a need for a foot rest that is more comfortably located in front of the chair for better ergonomics. There is also a need for adding multiple foot rests and a more ergonomic seat design that allow you to increase the range of healthy supported sitting positions available to the user and thus inspire movement between a variety of postures. This need includes adding foot rests that can be used while standing. This need also includes having a seat designed to allow the rotation of the pelvis in the anterior and posterior directions, with adjustable mechanical resistance. This provides significant musculoskeletal benefit to the spine by allowing movement and by making it easier to position the pelvis and back in healthy neutral ergonomic postures that reduce the strain on the spine and its supporting muscle groups. There is also still a need for a chair that is easy to store and carry. In conclusion, there is a need for all of the foregoing to be provided in one chair.

SUMMARY OF THE INVENTION

The present disclosure preserves the advantages of prior art chairs while providing new advantages not found in currently available chairs and overcomes many disadvantages of such currently available chairs. The present disclosure is generally directed to the novel and unique ergonomic standup chair that addresses all of the aforementioned problems associated with prior art chairs.

For example, in a preferred embodiment, the present disclosure provides a chair for standup use that can be folded for compact storage and transport while enabling in-place exercising. Further, the chair can be designed such that it can make easy transitions between sitting and standing or between different positions while seating.

A further object of the chair of the present disclosure is to include features that provide additional exercise and stretching capabilities such as sit-ups and back extensions. Accessories can be added to facilitate a full body workout.

Another object of the present invention is to provide a chair with both a foot rest that is more comfortably located in front of the chair for better ergonomics, and to provide multiple footrests to increase the variety of ergonomic sitting and standing positions that are available to the user.

Yet another object is to include foot rests that can be utilized while the user is standing to allow more ergonomic and dynamic standing positions.

A further object of the present invention to provide a chair that is easy to store and carry.

There is yet a further object of the present invention to provide a seat that allows adjustably dampened anterior and posterior pelvis rotation.

It is also an object to provide a seat pan that is optimally shaped to support the pelvis and spine in a wider range of healthy, ergonomic seated and leaning postures, and to support and inspire movement throughout the day.

BRIEF DESCRIPTION OF THE FIGURES

The novel features which are characteristic of the present disclosure are set forth in the appended claims. However, the invention's preferred embodiments, together with further objects and attendant advantages, will be best understood by reference to the following detailed description taken in connection with the accompanying drawings in which:

FIG. **1** shows a perspective view of an embodiment of the chair of the present invention;

FIGS. **2**A-**2**C shows side views of the chair of FIG. **1** in variety of configurations;

FIG. **3** is a top view of a base of the chair of FIG. **1**;

FIG. **4** is a partial perspective view of the chair of FIG. **1**;

FIG. **5** is a side view of the base of the chair of FIG. **1**;

FIG. **6** is a top view of the foot rest assembly of the chair of FIG. **1**;

FIG. **7** is a side view of the foot rest assembly of FIG. **6**;

FIG. **8** is a perspective view of the chair of FIG. **1** in a collapsed configuration;

FIG. **9** is a perspective view of the chair of FIG. **1**

FIG. **10** is a side elevation view of the chair of FIG. **1**;

FIG. **11** is a cross-sectional view of FIG. **11**;

FIG. **12** is a cross sectional view of the locking pin of the seat post of the chair of FIG. **1**;

FIG. **13** is a bottom perspective view of the seat of the chair of FIG. **1**;

FIG. **14** is a bottom view of the seat adjustment mechanism of the chair of FIG. **1**;

FIG. **15** is a front view of the chair of FIG. **1**;

FIG. **16** is a right side view of the seat of the chair of FIG. **1**;

FIG. **17** is a left side view of the seat of the chair of FIG. **1**;

FIG. **18** is a rear side view of the seat of the chair of FIG. **1**;

FIG. **19** is a top view of the chair of FIG. **1**;

FIG. **20** is a top view of the chair of FIG. **1** in a collapsed configuration; and

FIG. **21** is an isometric view of an alternative chair with a lower foot platform and upper loop foot restraint.

DETAILED DESCRIPTION OF THE INVENTION

Certain exemplary embodiments will now be described to provide an overall understanding of the principles of the structure, function, manufacture, and use of the device and methods disclosed herein. One or more examples of these embodiments are illustrated in the accompanying drawings. Those skilled in the art will understand that the devices and methods specifically described herein and illustrated in the accompanying drawings are non-limiting exemplary embodiments and that the scope of the present invention is defined solely by the claims. The features illustrated or described in connection with one exemplary embodiment may be combined with the features of other embodiments. Such modifications and variations are intended to be included within the scope of the present disclosure. Further, in the present disclosure, like-numbered components of the embodiments generally have similar features, and thus within a particular embodiment each feature of each like-numbered component is not necessarily fully elaborated upon. Additionally, to the extent that linear or circular dimensions are used in the description of the disclosed systems, devices, and methods, such dimensions are not intended to limit the types of shapes that can be used in conjunction with such systems, devices, and methods. A person skilled in the art will recognize that an equivalent to such linear and circular dimensions can easily be determined for any geometric shape. Further, to the extent that directional terms like top, bottom, up, or down are used, they are not intended to limit the systems, devices, and methods disclosed herein. A person skilled in the art will recognize that these terms are merely relative to the system and device being discussed and are not universal.

The chair **10** of the present disclosure, shown generally in FIG. **1**, is intended to balance safety, comfort, ergonomics, numerous desk geometries, a variety of floor surfaces, the physics of cantilevered elements, the height of floor obstacles, and a large range of body types/sizes. It addresses the recommendations of ergonomic experts and adds the unique forward footrests and upper exercise bar that encourage movement and provide the capability to perform core workouts and other types of workouts. The entire chair **10** folds into a compact light weight package for easy transport and stowage, as shown in FIGS. **2**A-**2**C.

The chair **10** of the present disclosure includes a number of subassemblies that interact to achieve the aforementioned benefits. For example, as shown in FIG. **1**, the chair **10** can generally include a base **100** which supports the chair **10**. The base **100** can pivotally receive a foot tube assembly **200** and a seat tube assembly **300**. The foot tube assembly **200** and the seat tube assembly **300** can be pivotally connected to the base **100** to permit the chair to fold for easy transport and stowage. The seat tube assembly **300** can receive the seat adjustment assembly, or mechanism, **400** which can support the seat **500**. The seat adjustment assembly **400** can allow for the seat to be adjusted in at least three degrees of freedom.

The base assembly **100** can generally provide a cantilevered support a user sitting on the chair **10**. The base assembly **100** can be manufactured from a plurality of parts, as illustrated, or can be manufactured from a single piece of material. In some embodiments, the base assembly **100** can be manufactured from metals, composite materials, plastics, wood, or a combination thereof. The base assembly **100** can be manufactured through stamping, molding, 3D printing or other manufacturing methods. The base assembly **100** can be made of four sub-assemblies, namely a center support **102**, forward legs **110**, a wheel assembly **120**, and rear legs **150**. In general, the center support **102** can include a proximal end **102***p* and a distal end **102***d*. The forward legs **110** can include a U-shaped cut out **112** which can receive the proximal end **102***p* of the center support. The proximal end of **102***p* of the center support **102** can be bolted to the

forward legs **110**, they can be welded together, or otherwise mechanically fixed relative to one another. The forward legs **110** can provide lateral support for the chair **10** as the two legs **110***a*, **110***b* extend from the central support **102**. In the illustrated embodiment, as shown in FIG. **3**, the legs **110***a*, **110***b* can be at a slight angle such that they slope towards the distal end **102***d* of the center support **102**. In alternative embodiments, the legs **110***a*, **110***b* can extend generally perpendicular to the central support **102** or can be angled such that they slope away from the distal end **102***d* of the center support **102**. At the respective ends **114***a*, **114***b* of the legs **110***a*, **110***b*, a foot **116***a*, **116***b* can be installed. The feet **116***a*, **116***b*, can extend from an underside of the ends **114***a*, **114***b*. In some embodiments, the feet **116***a*, **116***b* can be threaded into the underside of the ends **114***a*, **114***b* such that they can be adjusted to ensure that the legs **110***a*, **110***b* are stable during use. The forward legs **110** can alternatively be positioned and shaped to provide critical support needed for users who would like to work in supported ergonomic leaning or perching postures. The forward legs **110** can prevent a user's feet from uncomfortably sliding forward on the floor when trying to use the chair in this way. Without the forward legs **110** the strain required to resist the tremendous shear forces of the user's feet on the floor would make sitting in this position undesirable.

The forward legs **110** can additionally include a wheel assembly **120** disposed at a central forward location **118** of the forward legs **110**. The wheel assembly **120** can generally include a U-shaped bracket **122** disposed in a groove, not shown, on an underside of the legs **100**. The bracket **122** can include two laterally offset arms **122***a*, **122***b* which include through holes therein. A pin **124** can extend through the two through holes and be fixed therein. As shown, at least two wheels **126***a*, **126***b* can be rotatably disposed on the pin **124**. The wheels **126***a*, **126***b* can permit the chair **10** to be rolled across a surface when the chair **10** is pivoted upward about the pin **124**.

Returning to the center support **102**, a rear stability plate, or legs, **150** can be disposed at the distal end **102***d* of the center support **102**. A lower face of the distal end **102***d* of the center support **102** can rest on top of the rear stability plate **150**. In the illustrated embodiment, two rear legs **150***a*, **150***b*, can extend on either side having a generally right triangular shape. The rear stability plate can, as illustrated, be secured to the center support **102** with a plurality of screws **152**. Alternatively, the rear plate can be welded or otherwise secured to the center support **102**. The rear support plate **150** can additionally provide lateral support for the chair **10**.

At a forward, or proximal, position on the center support **102**, a pivot pin assembly **140** can be disposed on a top surface. The location of the pivot pin assembly **140** can be chosen to ensure that a proper balance is achieved when a user is seated on the chair **10**. The location of the pivot pin assembly **140** can be chosen to ensure that the center of gravity of a user can stay within a safe operating envelope of the base **100** to ensure that the chair **10** remains in stable operation. The pivot pin assembly **140** can pivotally secure the foot tube **200** and seat tube **300** to the base **100**. A pivot pin **142** can be disposed in through holes **144***a*, **144***b* respectively disposed through ears **146***a*, **146***b*. The ears **146***a*, **146***b* can be welded, or otherwise secured, onto the center support **102**. In the illustrated embodiment, the ears can have a generally triangular shape with a rounded top apex. The pivot pin **142** can be secured within the ears using c-clips **148***a*, **148***b* secured about the ends of the pivot pins on an outer surface of the ears **146***a*, **146***b* as shown in at least FIGS. **4** and **5**. The foot tube **200** and seat tube **300** can be inserted into the open space between the ears **146***a*, **146***b* before the pin **142** is inserted into the ears.

In addition to the pivot pin assembly **140** supporting the foot tube **200** and the seat tube **300**, a positioning arc **130** can be additionally disposed on the top surface **102***t* of the center support **102**. The positioning arc **130** can be generally centered over the ears **146***a*, **146***b*, as shown in FIGS. **2**A-**2**C. In the illustrated embodiment, the arc **130** can be an upside down U-shape or circular arc shape. The arc **130** can be welded or bolted to the center support **102**. The rotational positions of the foot tube **200** and the seat tube **300** can be fixed relative to the arc **130** by the insertion of pins into various through holes, notches, and arcs, as shown in one configuration in FIG. **4** and discussed further below. As illustrated in FIG. **5**, a first set of through holes **132***a*-**132***e* can be disposed on a proximal portion **130***p* of the arc **130**. These first set of through holes **132***a*-**132***e* can be used to fix the rotational location of the foot tube **200** or the seat tube **300** when the seat is in an open, unfolded, configuration, as will be discussed further below. A through hole in the shape of an arc **133** can be disposed proximate the top **130***t*, or keystone, of the arc extending distally towards the distal end **130***d* of the arc. The length of the arc **130** can permit the seat tube to translate within the arc **130** from a standing desk orientation, as shown in FIG. **2**A, to an orientation suitable for a standard desk, as shown in FIG. **2**B. At the distal end of the arc through hole **133**, a notch **134** can be disposed on the top surface of the arc **130**. In the distal end **130***d* of the arc, two additional through holes **135***a*, **135***b* can be located to secure the foot tube **200** and seat tube **300** when the chair is in a collapsed configuration. Alternatively, any number of notches, through holes, or through arcs can be made in the arc **130** to achieve a particular ergonomic need for the end user.

As noted above and shown for example in FIG. **4**, the foot tube assembly **200** can be pivotally attached to the base assembly **100** to allow for the foot rests to be disposed in a number of different positions. The foot tube **200** assembly can generally include a forked arm **210** received within a hook shaped tube **230**. The hook shaped tube **230** can have two sets of foot rests **244**, **254** disposed thereon. Alternatively, the foot tube assembly **200** can include any number of foot rests. The foot tube assembly **200** can be manufactured from any different material having suitable strength to support the weight of an adult, for example metals, plastics, wood, and composite material, or a combination thereof. The forked arm **210** can generally include two forked arms **212***a*, **212***b* extending from a support tube **216** creating a generally U-shape. The two forked arms can be separated by a distance that is approximately larger than the width of the arc **130** such that they can be disposed on either side of the arc **130**. At a proximal end of the forks **212***a*, **212***b*, a pivot pin through hole **213***a*, **213***b* can be coaxially arranged. The pivot pin through holes **213***a*, **213***b* can have a diameter sized to receive the pivot pin **142** to be pivotally supported by the base **100**. At a location distal to the pivot pin through holes **213***a*, **213***b*, the forks **212***a*, **212***b* can include locking pin through holes **214***a*, **214***b*. In the illustrated embodiment, as shown in FIGS. **4** and **6**, the locking pin through holes **214***a*, **214***b* can be threaded to receive a threaded locking pin **220**. The threaded locking holes **214***a*, **214***b* can be located on the forks **212***a*, **212***b* such that they are aligned with the various through holes **132***a*-**132***e*, **135***a*, **135***b* on the arc **130** when the foot tube **200** is installed onto the pivot pin **142**. When the locking holes **214***a*, **214***b* are coaxially aligned with one of the arc through holes **132***a*-**132***e*, **135***a*, **135***b*, the

threaded locking pin **220** can be disposed through the locking holes **214***a*, **214***b* and the respective arc through hole **132***a*-**132***e*, **135***a*, **135***b* to fix the rotational location of the foot tube **200**. The threaded locking pin **220** can include a pin portion **222**, a threaded portion **224**, and a knurled head **226**. In use, the pin portion **222** can be inserted first through the locking through hole **214***a* until the threaded portion **224** engage the threaded locking hole **214***a*. The locking pin **220** can be threaded through both an arc through hole **132***a*-**132***e*, **135***a*, **135***b* and then into the other foot tube through hole **214***b* and advanced into a locked configuration as the threads **224** engage the threads, not shown, in the threaded through hole **214***a*. The knurled head **226** can be textured, or knurled, to provide the user with added grip. In an alternative embodiment, the locking pin **220** can be spring loaded to bias the pin into a locking engagement with the arc through hole **132***a*-**132***e*, **135***a*, **135***b* and the other of tube locking through hole **214***b*.

At the distal end of the fork portion **210** a support tube **216** can extend distally having a diameter D**1**. The support tube **216** can have a generally circular cross-sectional shape. In alternative embodiments, the support tube **216** can have any cross-sectional shape. The support tube **216** can be telescopically received within the hook portion **230**, as shown in FIG. **7**. The support tube **216** and the hook portion **230** can be welded, riveted, or otherwise mechanically fixed together. In an alternative embodiment, the hook portion **230** can be received within the support tube **216**.

The hook portion, as shown in FIG. **7**, can include a first, proximal, straight section **232** which leads to a curved, or hooked, section **234**, and can end with a second, distal straight section **236**. The hook portion **230** can be a hollow shaped tube having a generally circular cross-section. In alternative embodiments, the hook portion **230** can be solid and have any cross-sectional shape that may receive the support tube **216** of the fork portion **210**. At a medial location **232***m* of the first section **232** a first foot rest **240** can be disposed. In alternative embodiments, the first foot rest **240** can be disposed at other locations on the foot tube **200**. The term "foot rest" can include any of a tube, a tube with foam, a cross bar, platforms, rigid loops, straps, or other structure to support a portion of a user. The first foot rest **240** can include a tube **242** having two sides **242***a*, **242***b* on either side of the first section **232**. The two sides **242***a*, **242***b* can each have foam tubes **244***a*, **244***b* disposed thereon. The foam tubes **244***a*, **244***b* can advantageously provide for an added level of comfort for when the user is in contact with the first foot rest **240**. Alternatively, the foam tubes **244***a*, **244***b* can be tubes made from other materials. In a further alternative embodiment, the foot rests **240**, **250** can be any of a cross-bar, platform, loop, or other forms of foot restraints. In an alternative embodiment, as shown in FIG. **21**, in place of the first foot rest **240**, a platform **261** can be disposed on either side of the foot tube **200**. The platform **261** can be an ergonomically shaped platform made from wood, plastic, metal, or a combination thereof. In some embodiments, the platform **261** can have a layer of foam or other materials layered on top for added comfort.

As shown in FIG. **7**, at a distal location **236***d* of the second straight section **236** a second foot rest **250** can be disposed. In alternative embodiments, the second foot rest **250** can be disposed at other locations on the foot tube **200**. The second foot rest **250** can include a tube **252** having two sides **252***a*, **252***b* on either side of the second section **236**. The two sides **252***a*, **252***b* can each have foam tubes **254***a*, **254***b* disposed thereon. The foam tubes **254***a*, **254***b* can advantageously provide for an added level of comfort for when the user is in contact with the first foot rest **240**. Alternatively, the foam tubes **254***a*, **254***b* can be tubes made from other materials including wood or plastics. In an alternative embodiment, as shown in FIG. **21**, the second foot rest **250** can be in the form of an exercise bar **260**. The exercise bar **260** may be an aluminum loop with foam padding which provides the user with more secure support when stretching or doing sit-ups since it allows a user to lock your feet into it. Not shown, either of the first or second foot rests **240**, **250** can be any of a foot rest, platform, exercise bar, loop, or other forms of foot restrains in any combination. The foot rest **240** can be positioned to support the user in ergonomic seated postures and stretching exercises. The foot rest **250** can be positioned to additionally support the user in ergonomic seated postures, but also is correctly placed to support the users legs when doing a sit-up.

In addition to the foot tube **200** providing support for a user, a seat **500** is pivotally connected to the base **100**. The seat **500** rests upon an adjustable seat tube, or post, **300** that is pivotally receives the pivot pin **142**. The seat tube **300** can be manufactured from any different material having suitable strength to support the weight of an adult, for example metals, plastics, wood, and composite material, or a combination thereof. In general, the seat tube can be a height adjustable assembly made from a tube **310** and an inner tube **360**. The tube **310** can have a generally rectangular, or square, or circular cross-section having a lumen **311** extending from a proximal most end **310***p* to a distal most end **310***d*. At the distal end of the tube **310** can have a fork structure **312** extending distally therefrom. Forks **312***a*, **312***b* can be laterally disposed from one another a first distance D**1**. The first distance D**1** is sized to receive both fork **212** of the foot tube therein such that the fork tube can rotate, or pivot, about the pin **142** concurrently with the seat tube **300**. At a distal end **312***d* of the forks, there are respective pivot through holes **313***a*, **313***b* for receiving the pivot pin **142**. During construction of the chair **10**, the fork **312** can be inserted between the ears **146***a*, **146***b*, and the fork **212** can be disposed between the forks **312***a*, **312***b* such that the respective pivot through holes of the forks **212**, **312**, and the ears **146***a*, **146***b* are coaxially aligned to receive the pivot pin **142**. An upper U-shaped opening can extend proximally from where the forks extend thereby defining an opening with a second distance D**2**. The second distance D**2** can be sized to slidably receive the arc **130**. At the same height of the U-shaped opening, a support and locking assembly can be disposed within the interior lumen **311** of the tube **310**.

The support, or seat tube reinforcement block **330**, can be telescopically received in the lumen **311** to provide additional structural support for the seat tube **300**. The support **330** can be manufactured from a urethane, metal, or composite materials. The support **330** can be generally cylindrical having a corresponding opening to the opening of the tube **310**. When installed within the lumen **311** of the tube **310**, the opening **332** of the support **330** can be aligned with the opening of the tube **310** to receive the arc **130**. The bottom surface of the opening can ride, or contact, the upper surface of the arc **130**. In the illustrated embodiment, the support **330** is retained within the lumen **311** with a screw **334** inserted into the rear face **310***r* of the tube **310**. Alternatively, the support **330** can be glued, welded, or otherwise retained in the lumen **311** to prevent the support **330** from migrating, or moving, within the lumen **311**.

A stop pin assembly **340** can be disposed at the distal end **310***d* of the tube **310**. The stop pin assembly **340** can extend perpendicularly to tube **310**, substantially at the location of the openings **314**, **332**. On either side of the tube **310**, two

stop pin housings **342***a*, **342***b* can house the stop pin **344**, biasing spring **345** and retaining screws **346***a*, **346***b*. The retaining screws **346***a*, **346***b* can have one end threaded on to the respective housings **342***a*, **342***b* and the opposite end threaded into the tube **310** and support **330** to retain the housings **342** on the tube **310**. A pin **344** can extend in the housing **342***a*. The pin **344** can have a head **344***h* disposed outside the housing **324***a*. The stop pin assembly **340** can additionally include a compression spring **345** to bias the tip of pin **344***t* through the openings of the arc **130**. The pin can have a stop **344***s* that can abut an end of the retaining screw **346***a* to prevent the pin from over extending into the housing **342***a*. The head **344***h* can be grasped by a user to withdraw the pin **344** from engagement with the various through holes and arc holes **132***a*-**132***e*, **133**, **135***a*, **135***b* of the arc **130**. In use, the head **344***h* can be pulled away from the arc **130** to remove the pin **344** from engagement with the arc **130**. Once the preferred location of the seat tube **300** is attained, the user can release the head **344***h* and the spring **345** can bias the pin **344** back into engagement. Alternatively, other stop mechanisms can be used to retain the rotational configuration of the seat tube **300** relative to the arc **130**. In use, the housing **342***a*, **342***b* can serve as additional footrests that may be used by the user while sitting or standing. Further, the housings **342***a*, **342***b* can be used as a step to aid a user when they are getting onto the seat **500**.

An additional retaining mechanism **350** in the form of a stop pin **352** can be disposed on the rear face **310***r* of the tube **310** in a rear housing **354**. In an exemplary embodiment, the rear housing **354** can be welded or screwed onto the rear face **310***r* of the tube **310**. The rear housing **354** can have a through hole **356** which can slidably receive a stop pin **352**. In some embodiments the stop pin **352** can be a cylindrical pin, a bar, or other shapes. The stop pin **352** can be sized to be received within the notch **134** of the arc **130** to prevent the tube **310** from over rotating towards the distal end **130***d* of the arc **130**. In some embodiments, the retaining mechanism **350** may not be included.

As noted above, the proximal end of the tube **310***p* can be open to telescopically receive an inner tube **360** which supports a seat adjustment, or rod, assembly **400** and a seat **500**. The inner tube **360** can have a generally rectangular, trapezoidal, square, or circular cross-section that matches the cross-section of the inner lumen **311** of the tube **310**. In some embodiments, the external cross-sectional shape of the tube **310** can be different than the internal cross-sectional shape of the lumen **311**. The cross-sectional shapes of the inner tube **360** and the lumen **311** may be chosen to prevent the inner tube **360** from rotating within and relative to the tube **310**. Along the length of the inner tube **360**, a series of through holes **362** can be made through at least one face of the inner tube **360**. In an alternative embodiment, the through holes **362** can extend from one face of the inner tube **360** to another face of the inner tube. The through holes **362** can be made at any desirable interval. The interval, or distance between the holes can provide for added granularity in adjustment of the relative height of the inner tube **360** to the tube **310**. As the seat **500** is fixed to the proximal end **360***p* of the inner tube **360**, the height of the seat **500** can be adjusted as the inner tube **360** is moved within the tube **310**.

The relative height of the inner tube **360** can be locked with respect to the tube **310** with a height locking pin **370**. As illustrated, the height locking pin can be disposed at the proximal end of the tube **310**. The height locking pin **370** can be disposed in a housing **372** which houses the pin **370** and a biasing spring, not shown. The biasing spring can bias the pin **370** in a direction towards the inner tube **360**. In use, the pin can be withdrawn, away from the inner tube **360** to allow the inner tube to slide within the tube **310** to adjust the height of the seat **500**. Once the desired height is achieved, the pin **370** can be release and biased into engagement with one of the through holes **362** in the inner tube **360**.

Returning to the inner tube **311**, a seat tube adapter **380** can be disposed on a distal most end **311***d* of the inner tube **311**. The seat tube adapter **380** can provide a support to receive the seat adjustment mechanism **400**. The seat tube adapter **380** can telescopically receive the distal end **311***d* of the inner tube **311** at a forward end thereof, as shown in FIG. **11**. In some embodiments, the seat tube adapter **380** can be welded or otherwise mechanically secured to the inner tube **311**. Further, the seat tube adapter **380** can have a cylindrical through hole **382** at a rear end thereof. The cylindrical through hole **382** can receive a yaw pin **402** of the seat adjustment mechanism **400**. When the yaw pin **402** is received within the through hole **382**, the seat adjustment mechanism can rotate within the through hole to provide a first degree of freedom, or adjustment for the seat **500**.

The seat adjustment mechanism **400** can provide, for example, three degrees of freedom, or adjustment, for the seat **500** relative to the seat tube assembly **300**. As noted above, the yaw pin **402** can be seated in the seat tube adapter **380** to allow the seat **500** to pivot about the seat tube adapter **380**, as illustrated in FIG. **11**. Further, a user may desire to adjust the anterior/posterior location of the seat, relative to the seat tube adapter **380**. To achieve this sliding ability of the seat, a rod base **410** can be fixed onto the proximal end of the yaw pin **402**. The yaw pin **402** can be disposed in a through hole of the rod base **410** or can be welded to an underside **410***u* of the rod base **410**. The rod base **410** can slidably support a slider top plate **420** which can permit the seat **500** to slide anteriorly A and posteriorly P as shown in FIG. **16**. The slider top plate **420** can include a substantially flat rectangular plate **422** having two downward extending sidewalls **424***a*, **424***b*, parallel to one another on a first two sides and two upward extending parallel sidewalls **423***a*, **423***b* on the other two sides.

The rod base can include two through holes **411***a*, **411***b* which are oriented perpendicular to the yaw pin **402**. The two through holes **411***a*, **411***b* can be spaced apart a set distance and have a diameter D3. The diameter D3 of the through holes **411***a*, **411***b* can be sized to slidably receive rod shafts **413***a*, **413***b*. The two through holes **411***a*, **411***b* can have oil embedded flange sleeve bearings, not shown, to reduce any frictional forces between the through holes **411***a*, **411***b* and the rod shafts **413***a*, **413***b*. The two rod shafts **413***a*, **413***b* can be secured to the downward side walls **424***a*, **424***b* of the top slider plate **420** so that the as the rods **413***a*, **413***b* move relative to the rod base **410**, the top slide plate **420** moves as well. The assembly can additionally include a gas spring **415** which can provide resistance to the rods **413***a*, **413***b* from sliding relative to the rod base **410**. As shown in FIG. **14**, the gas spring **415**, can have a first end, or the cylinder, **415***a* fixed in the downward side wall **424***b* and the other end, or piston rod **415***b*, fixed to a flange **418** in the base **410** such that it is parallel to the two rods **413***a*, **413***b*. In some embodiments, the gas spring **415** can be adjustable to provide the user the ability to adjust the amount of resistance to sliding of the slider top plate **420** relative to the base **410**.

In addition to the sliding movement of the seat **500** and the pivoting about the yaw pin **402**, the seat **500** can additionally pivot about an axis that is perpendicular to both the yaw pin and the sliding rods. This further pivoting can provide a user with the ability to adjust the pelvic alignment

of the seat **500**. Additionally, pivoting about the yaw pin **402** can provide a user with the ability to perform a rocking movement to support muscles of the spine and provide relieve from the strain of maintaining static seated positions. The slider top plate **420** can include through holes **424***a*, **424***b* in the respective upward sidewalls **423***a*, **423***b*. A seat hinge pin **430** can be inserted through the through holes **424***a*, **424***b*. A seat mount **450** can be pivotally disposed on the seat hinge pin **430** to create a "hinge" joint between the seat **500** and the slider top plate **420**. The seat mount **450** can include two downward depending sidewalls **452***a*, **452***b* each of which can be parallel to the upward sidewalls **423***a*, **423***b*. The two downward depending sidewalls **452***a*, **452***b* can each include an ear **453***a*, **453***b* which have coaxially aligned through holes. The two downward depending sidewalls **452***a*, **452***b* can be offset from one another such that when they are joined to the hinge pin **430** they are disposed outward of the two upward sidewalls **423***a*, **423***b*.

In order to prevent the seat mount **450** from freely pivoting about the hinge pin **430**, a set of torsion springs **460***a*, **460***b* can be disposed on the pin **430** on either side of a belt **462***a*. The two torsion springs **460***a*, **460***b* and the belt drum **462***b* can be disposed on the pin **430** between the two upper sidewalls **423***a*, **423***b*. Alternatively, other arrangements of the torsion springs **460***a*, **460***b* are within the scope of this disclosure. One arm of each of the torsion springs **460***a*, **460***b* can be disposed within the belt drum **462***b* and the other arm of each of the torsion springs can apply a counter force to the slider top plate **420** to resist pivoting movement of the seat mount **450**. The torsional resistance provided by the torsion springs **460***a*, **460***b* can be adjusted by rotating the tension knob **480**, which is connected to a screw type mechanism that can apply a force to the belt **462***a*. The belt **462***a* can transmit the force to the perimeter of belt drum **462***b* to vary the torque on springs **460***a* and **460***b*. The slider top plate **420** can further include a stop finger plate **470** extending outward from the upward extending sidewall **423***a* to serve as a physical barrier to the seat mount **450** from over rotating or pivoting. The stop finger plate **470** can be engaged or disengaged through actuation of the stop knob **471** which applies or releases friction on the stop finger plate.

The seat mount plate **450** can securely retain the cushioned seat **500** such that the seat **500** is able to be angularly adjusted relative to the base **100**, height adjusted relative to the base **100**, pivot about the yaw pin **402**, slide on the rods **413***a*, **413***b*, and pivot about the hinge pin **430**. The seat **500** can be secured to the seat mount plate using a plurality of screws, nails, staples, glue, or can be welded. The seat **500** can generally include a fabric covered cushion **502** and two laterally extending handles **504***a*, **504***b*. The cushion **502** can be manufactured from a single piece of material, such as polyurethane, foam, memory foam, or other materials mounted on a piece of wood, metal, or plastic, not shown, and covered with fabric. In an alternative embodiment, the cushion **502** can be made from a plurality of pieces of material. The shape of the seat can be shaped to position a user's pelvis into more ergonomic positions that support healthy strain-reducing spine postures. The pivoting of the seat, as discussed above, further aids in achieving this desired outcome.

In order to provide the user with additional support, the seat **500** can include two handles **504***a*, **504***b*. The two handles **504***a*, **504***b* can generally be the same shapes and size. For ease of discussion, one handle **504***a* will be discussed in detail. The handle **504***a* can have a generally upside-down U-shape with a further perpendicular bend at the ends of each arm of the U to form anchor arms **514***a*, **514***b*. The anchor arms **514***a*, **514***b* can be perpendicular to the top portion of the U-shape and can be screwed into the bottom of the seat **500** to secure them thereto. In the illustrated embodiment, the U-shape **510** is formed of a circular rod portion and the anchor arms **514***a*, **514***b* are shown as flat plates. However, the handles **504***a*, **504***b* can be formed from any suitable cross-sectional shape.

In use, a user can fully adjust the seat **10** in a wide range of orientations, as shown throughout the figures. For example, in a fully opened, or unfolded configuration, the foot rest locking pin **226** can be released to allow the foot rest post **200** to be rotated about the pivot pin **146**. The foot rest post **200** can be advanced to one of the through holes **132***a*-**132***e* and the locking pin **226** can then be released at the correct ergonomic position for the user. Once the locking pin **226** is released it can be inserted into the respective through hole **132***a*-**132***e* to lock the relative angle of the foot rest post **200**. Similarly, locking pin **340** of the seat tube, or post, **300** can be released from the arc **130** and the seat post **300** can be rotated up to the arc through hole **133**, for example as shown in FIG. **2**A. The retaining mechanism **350** can be actuated into the notch **134** to prevent the seat post **300** from rotating forwards when the user wants to position the chair on the floor. In an alternative configuration, the seat post **300** can be rotated further from the orientation of FIG. **2**A, such that the locking pin **340** is disposed in a forward location **133***p* of the arc through hole **133**, as shown in FIG. **2**B. The configuration of FIG. **2**B can be useful, e.g., when a user is standing at a desk.

The seat tube **300** can be further adjusted by releasing the height locking pin **370** to move the inner tube **360** within the seat tube **310**. Sliding the inner tube **360** within the seat tube **310** can adjust the height of the seat **500**. In some instances, it may be beneficial to lower the seat **500** if the chair **10** is being used at a traditional sitting desk. Alternatively, the seat **500** can be raised if the chair is being used in connection with a standing desk.

The seat **500** itself can be adjusted relative to the seat post **300** in at least three degrees of freedom, as discussed above. The seat **500** can rotate about the yaw pin **402** to advantageously access the entirety of a desktop, to enter and exit the seat, to provide optimal seating comfort in a number of different positions, and for compact storage in the stowage configuration. From a health/ergonomic perspective, the pivoting about the yaw pin **402** can allow a user to rotate/twist their body. This movement can provide muscle relief and help increase circulation through the user's spine and body. The seat **500** can be pivoted about the hinge pin **430** to ensure that there is proper pelvic alignment and allow rocking movement that can give the muscles that support the spine breaks from the strain of maintaining static seated positions. Additionally, the seat **500** can be moved anteriorly A or posteriorly P, away and towards the foot rest **200**, to ensure that the users legs are properly supported.

When a user no longer needs the chair **10** in an unfolded configuration, the above steps can be reversed to collapse the chair into the collapsed configuration, as shown in FIG. **2**C. Optionally, the inner tube **360** can be lowered fully into the seat tube **310**. The retaining mechanism **350** and the locking pin **370** can be released to allow the seat post **300** to rotate towards through hole **135***b* on the arc **130**. Once the seat post has been fully collapsed, the locking pin **370** can be inserted into the through hole **135**. The foot rest post **200** can similarly be unlocked and rotated towards through hole **135***a* to be locked for the collapsed configuration. The user can then lift the base **100** from, for example, the rear stability

plate **150** to pivot the assembly upwards on the wheels **126***a*, **126***b* to roll the chair **10** into a storage location.

The chair of the present invention addresses the shortcomings of the prior art. For example, the chair can flip under the desk when not in use. It provides micro- and macro-movement core exercises, as well as other fitness exercises for other parts of the body, multiple seating, standing and leaning positions to maximize comfort and health. It provides fully adjustable pelvic rotation with graduated damping. It provides adjustable sit-up, back extension, and stretching exercise capability. It also incorporates multiple foot rests at ergonomically recommended (and comfortable) locations in front of chair in addition to foot rests that can be used while sitting. Further, pegs at the center of the base can be used to support the user in a variety of standing positions. Further, it utilizes an ergonomically designed seat with customizable features to suit any body shape, and a custom combination of polyurethane foams that provide optimal support and comfort. In addition, it quickly and easily folds into a compact, easy to transport package. It is may be constructed of wood or stamped or cast aluminum components for low-cost and light weight. Thus, the chair is designed for manufacturability, using stampings, castings, machined, and injection molded parts to reduce cost.

It would be appreciated by those skilled in the art that various changes and modifications can be made to the illustrated embodiments without departing from the spirit of the present invention. All such modifications and changes are intended to be covered by the appended claims.

What is claimed is:

1. An ergonomic chair, comprising:

a base including a central support and at least one lateral support;

a seat post having a first end and a second end;

the seat post being pivotally connected to the base by the first end of the seat post;

a seat connected to the second end of the seat post;

a seat mechanism disposed between the seat and the second end of the seat post, the seat mechanism is configured to pivot and slide the seat anteriorly and posteriorly, wherein the seat mechanism includes a seat support spring to adjust a stiffness of the pivoting of the seat;

a foot rest post having a first end and a second end, the foot rest post being pivotally connected to the base by the first end of the foot rest post;

a first foot rest connected to the second end of the foot rest post; and

a second foot rest connected to an intermediate portion of the foot rest post.

2. The ergonomic chair of claim **1**, wherein the seat post is telescopically adjustable.

3. The ergonomic chair of claim **1**, wherein the foot rest post is pivotally adjustable around a main pivot connection pin.

4. The ergonomic chair of claim **1**, wherein the seat is slidably adjustable relative to the seat post in the anterior and posterior directions.

5. The ergonomic chair of claim **1**, wherein the seat post includes integral foot supports.

6. The ergonomic chair of claim **1**, further comprising at least one additional foot rest.

7. The ergonomic chair of claim **1**, wherein an angle of the seat is adjustable and includes an adjustable stop to limit how far forward the seat can tilt or pivot.

8. The ergonomic chair of claim **1**, wherein the base further includes wheels for ease of transport.

9. The ergonomic chair of claim **1**, wherein the chair is foldable to facilitate storage and transport.

10. The ergonomic chair of claim **1**, wherein the base further includes an arc extending from the top of the central support configured to be slidably received by both the seat post and the foot rest post.

11. The ergonomic chair of claim **10**, wherein the seat post and the foot rest post each include a locking mechanism to fix their pivotal location with respect to the arc.

12. The ergonomic chair of claim **1**, wherein the seat includes a plurality of handles.

* * * * *